Integrative phylogeography of rodents from Sudanian savanna

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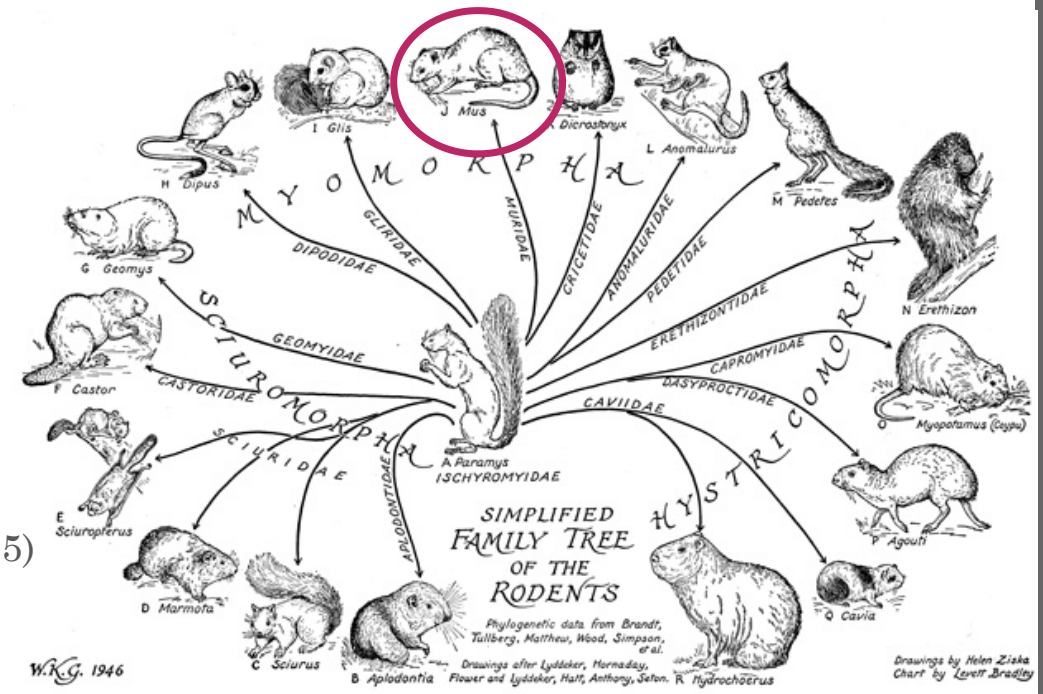
Rodents as model organism

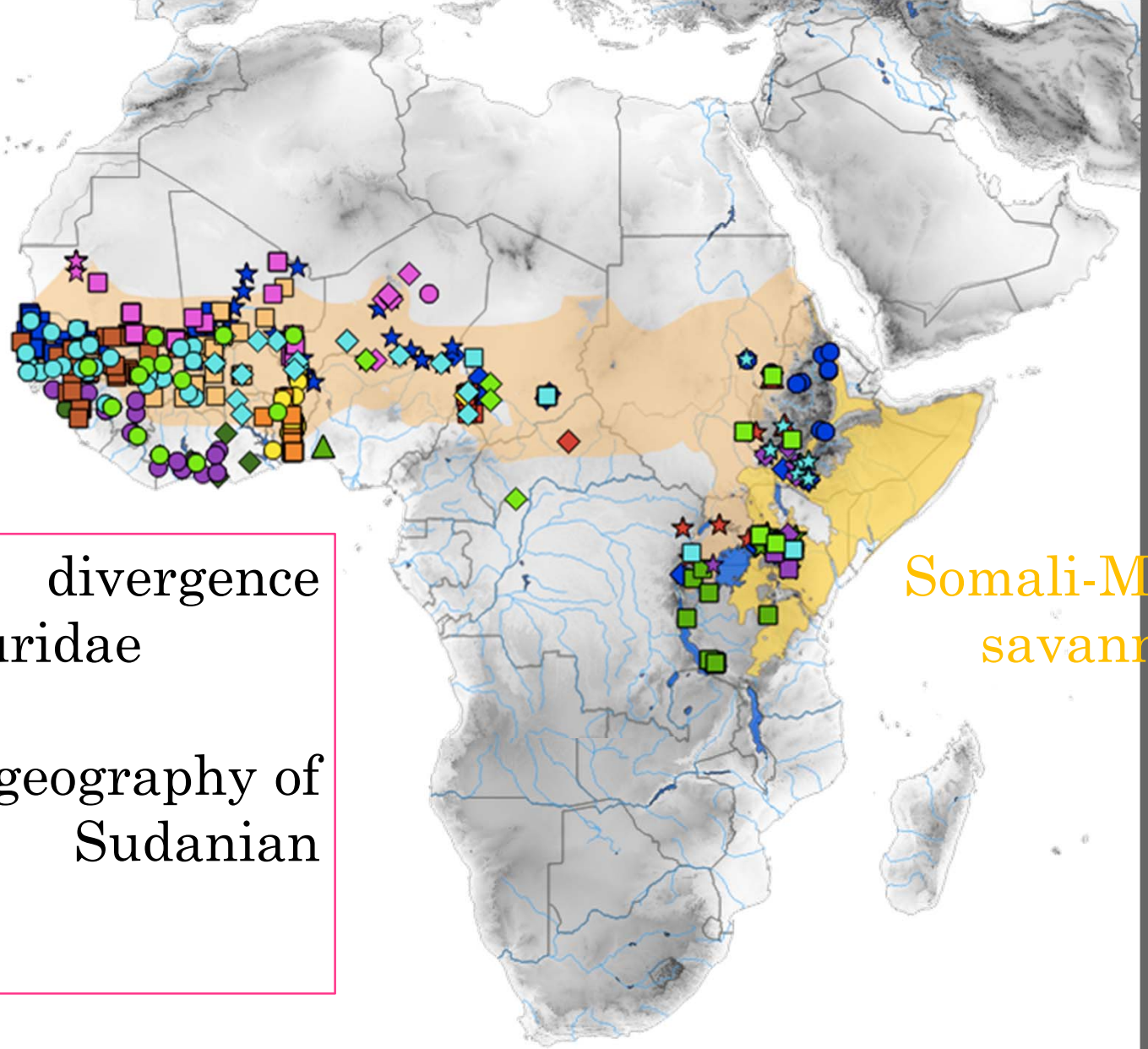
- Muridae Illner, 1911
  - 122 genera and 529 species (Musser & Carleton 1993)
  - 150 genera and 730 species (Musser & Carleton 2005)
  - Taxonomic changes
    - Lophiomyinae
    - Acomys
    - Otomyini
  - New species
    - *Waiomys mamsea* (Rowe et al. 2014)
    - *Hylomyscus heinrichorum* (Carleton et al. 2015)
    - *Lamottemys okuensis* (Missoup et al. 2016)



Aims

1. Phylogeny and divergence dating of family Muridae

2. Comparative phylogeography of rodents from Sudanian savanna



1. Phylogeny and divergence dating of family Muridae

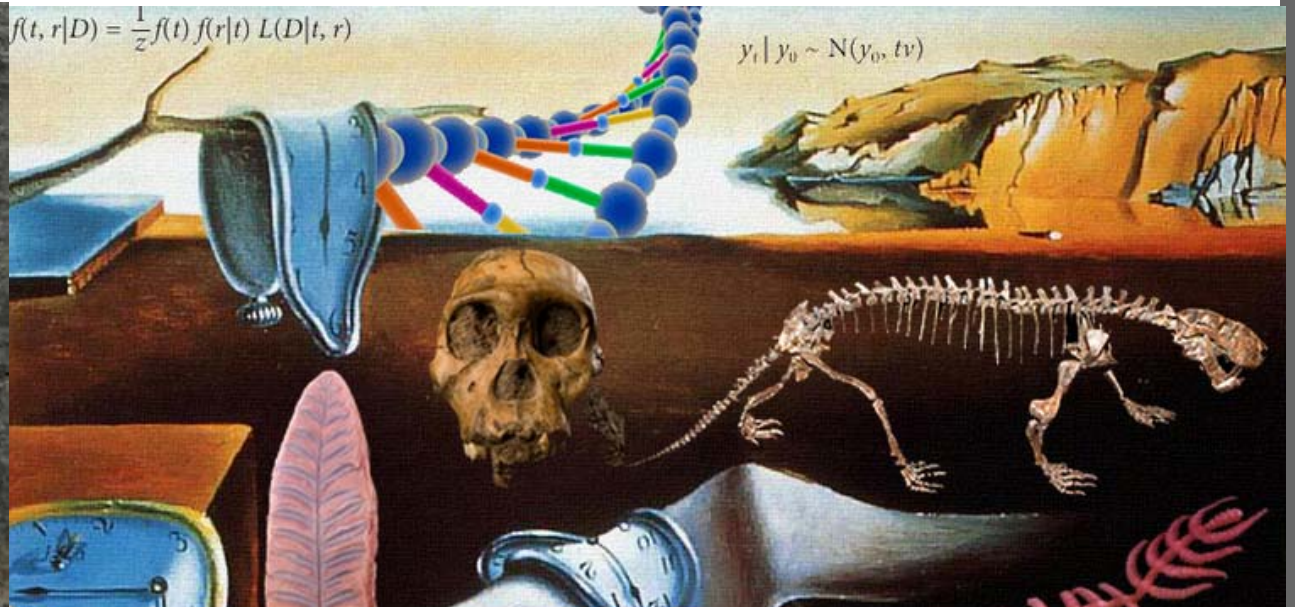
Matrix

- 159 ingroup species + 6 ougroup
- 10 molecular markers (10 500 bp), 45% missing data
- RAxML, MrBayes
- BEAST (different models and priors)

	Focus	Subfamilies	# genera	# species	Fossils in Muridae	Genetic markers
Fabre et al. (2012)	Rodentia	4	105	302	0	11
Schenk et al. (2013)	Muroidea	4	85	136	4	4
our study	Muridae	3	75	159	13	10
Rowe et al. (2008)	Hydromyinae	3	66	78	2	8
Lecompte et al. (2008)	Murinae	3	46	83	2	3

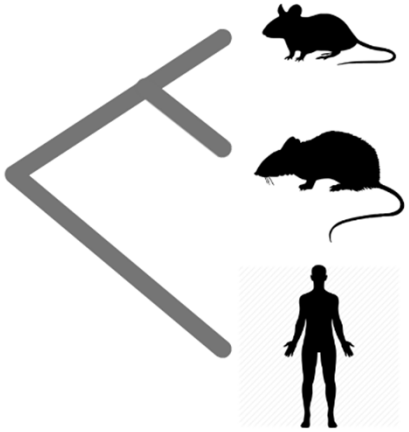
Molecular clock

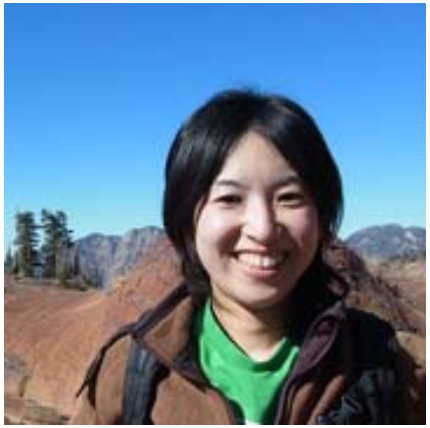
- Zuckerkandl & Pauling 1962
- Calibration
  - Geological events
  - Estimate from independent molecular dating studies
  - Fossil records



Fossils selection *a priori*

	MAKF	Position on phylogenetic tree	Age
1	Antemus chinjiensis	crown Murinae	13.8
2	?Karnimata	Mus/Arvicanthis split	11.1
3	Karnimata darwini	Millardini/Otomyini/ Arvicanthini	9.2
4	Aethomys	Aethomys crown	6.1
5	Lemniscomys	Lemniscomys crown	6.1
6	Arvicanthis	Arvicanthis crown	6.1
7	Mastomys	Mastomys crown	6.1
8	Mus	Mus crown	8.0
9	Apodemus lugdunensis	Apodemus crown	9.6
10	Preacomys kikiae	Acomys crown	8.5
11	Gerbillus sp.	Gerbillus crown	2.4
12	Gerbilliscus	Gerbilliscus crown	6.1
13	Abundhabia pakistanensis	Gerbilliscus/ Desmodillus split	8.7





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Corrected placement of *Mus-Rattus* fossil calibration forces precision in the molecular tree of rodents

Yuri Kimura[1,4], Melissa T. R. Hawkins[2,3], Molly M. McDonough[2,3], Louis L. Jacobs[4] & Lawrence J. Flynn[5]

Fossils selection *a posteriori*

	MAKF	Position on phylogenetic tree	Age
1	Antemus chinjiensis	crown Murinae	13.8
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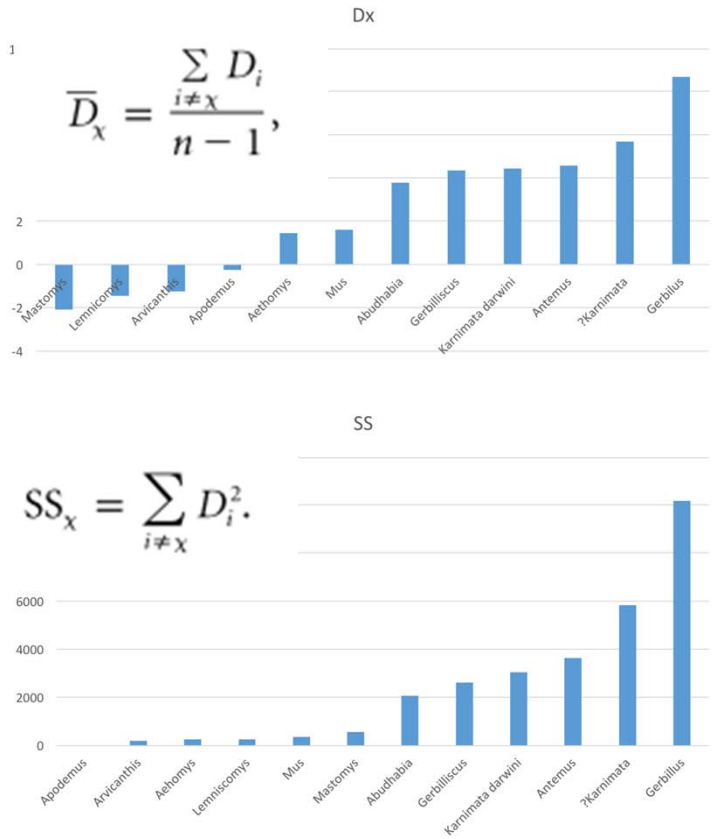
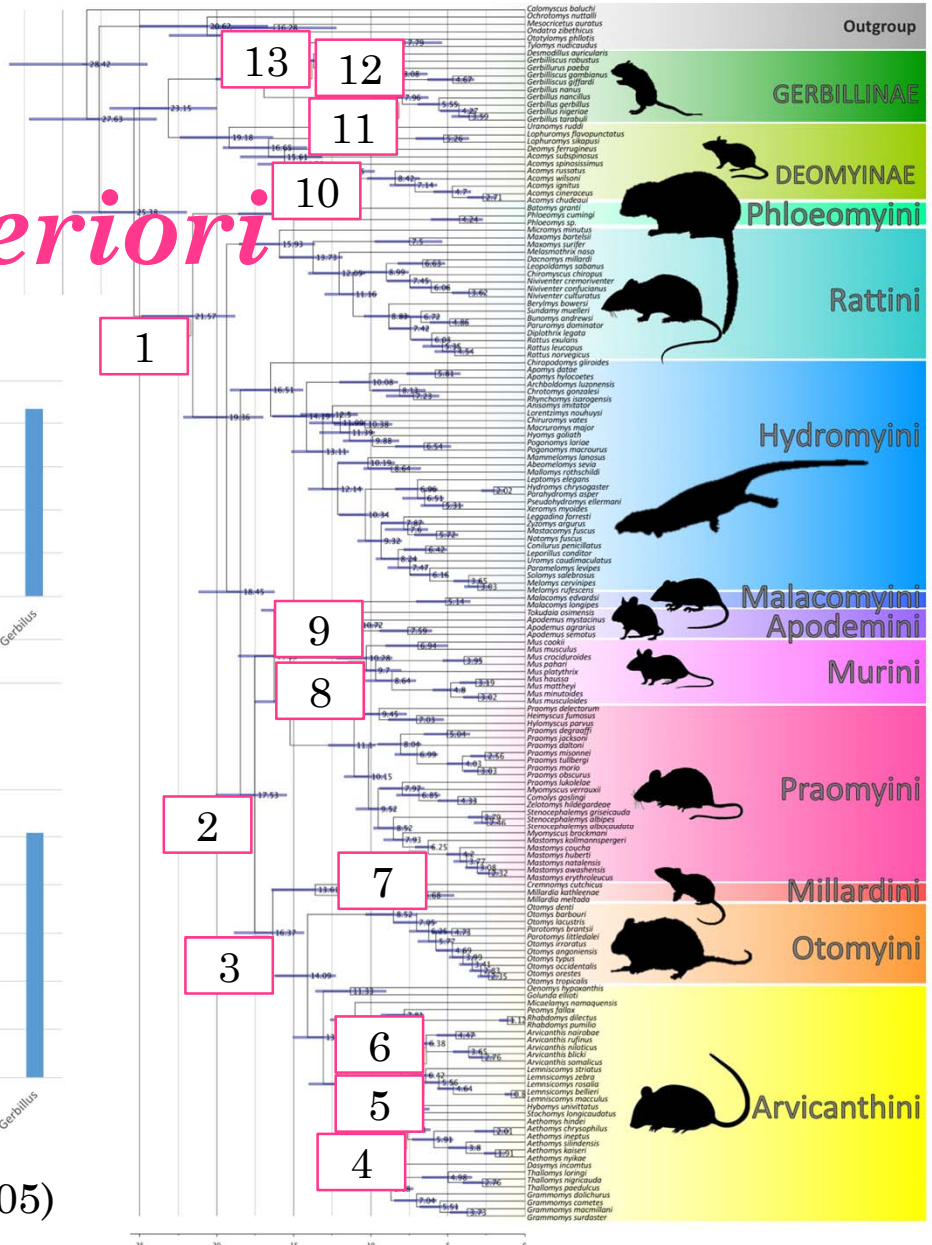
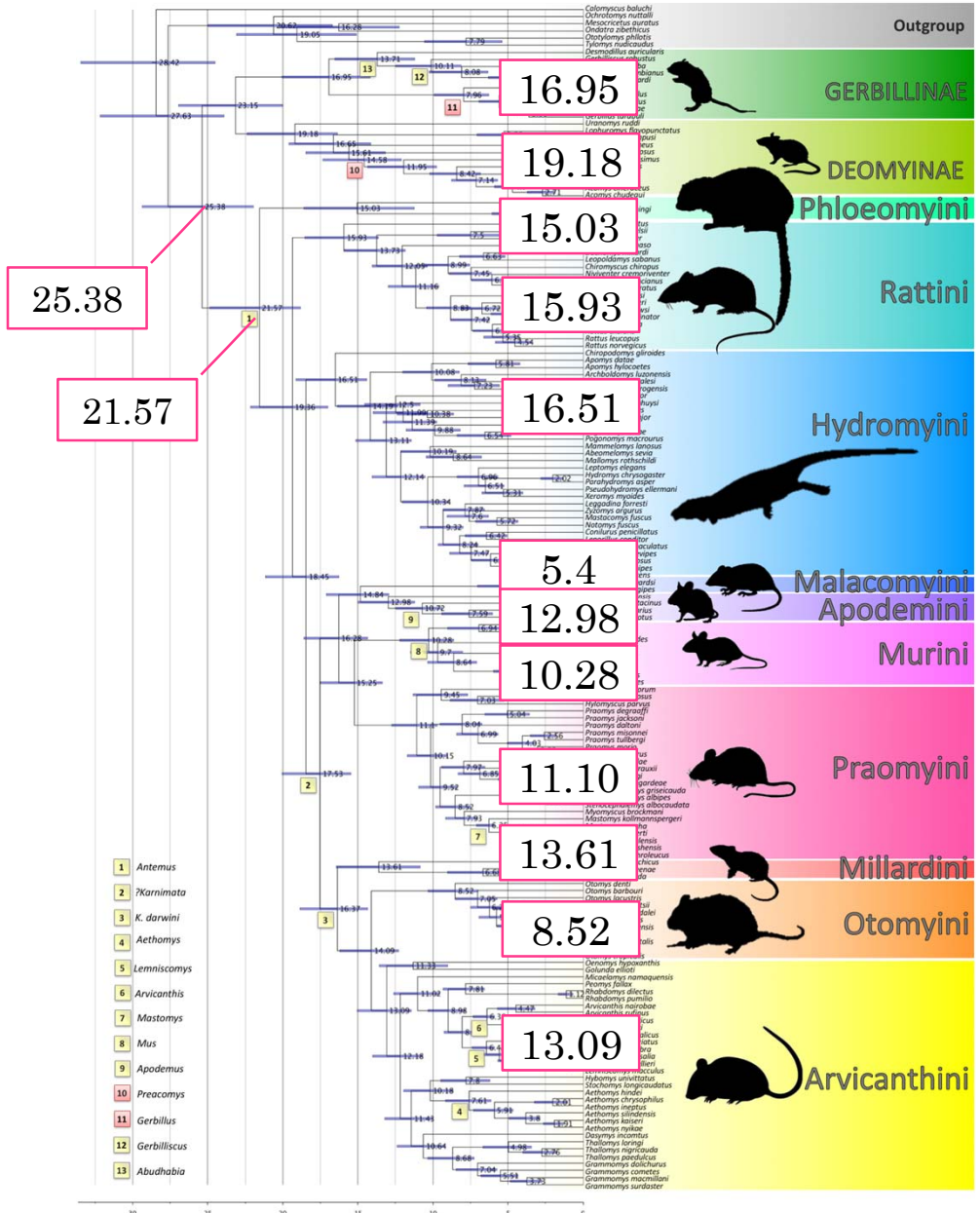


Near et al. (2005)



Results

TMRCA	Median	2.5%	97.5%
Muridae	25.38	21.96	29.35
Gerbillinae	16.95	14.18	20.07
Deomyinae	19.18	16.37	22.38
Murinae	21.57	18.83	24.87
Phloeomyini	15.03	11.24	18.60
Rattini	15.93	13.63	18.53
Hydromyini	16.51	14.4	19.12
Malacomyini	5.14	3.54	7.04
Apodemyini	12.98	11.23	14.99
Murini	10.28	8.62	12.2
Praomyini	11.10	9.72	12.73
Millardini	13.61	10.84	16.44
Otomyini	8.52	7.01	10.32
Arvicanthini	13.09	11.43	15.03



Historical biogeography

ECOZONES:

Western Palearctic (1)

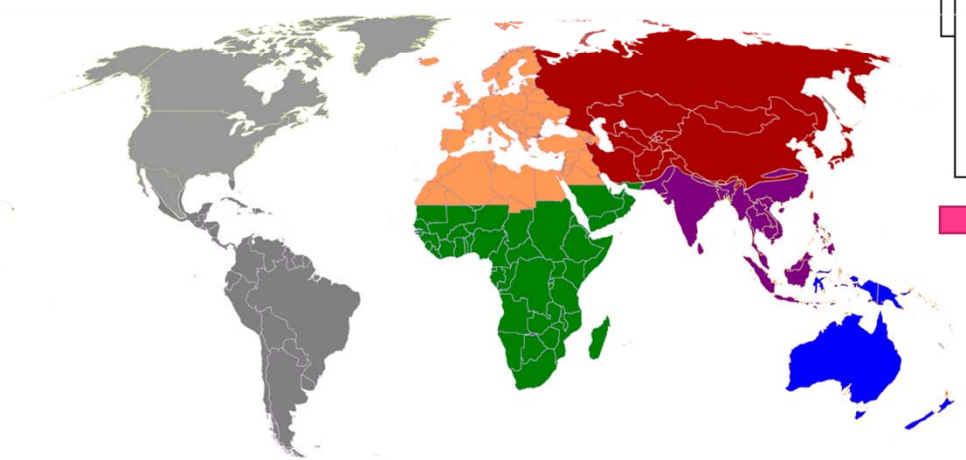
Eastern Palearctic

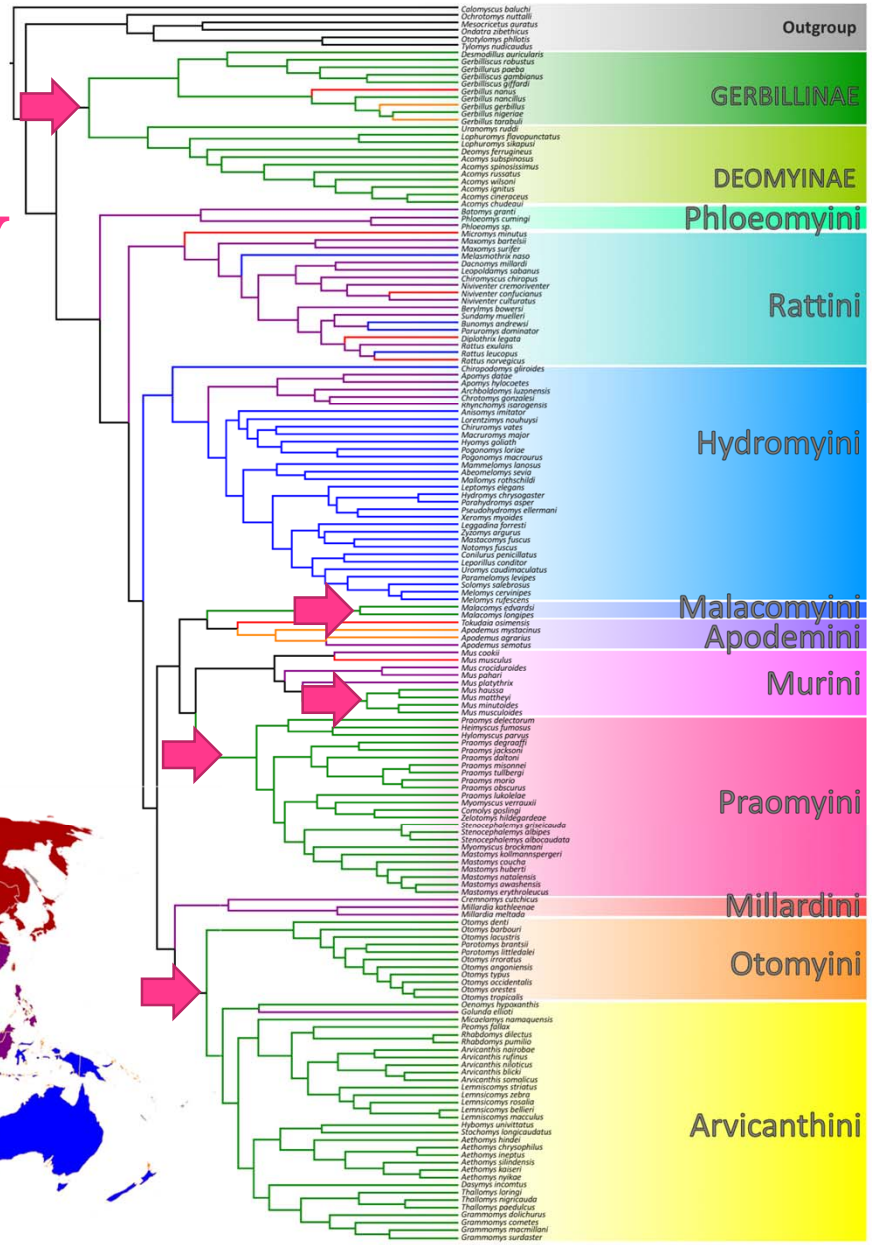
Indo-Malay (5)

Australasia

Afro-tropical (7)

BioGeoBEARS (Matzke 2013)





2. Comparative phylogeography of rodents from Sudanian savanna

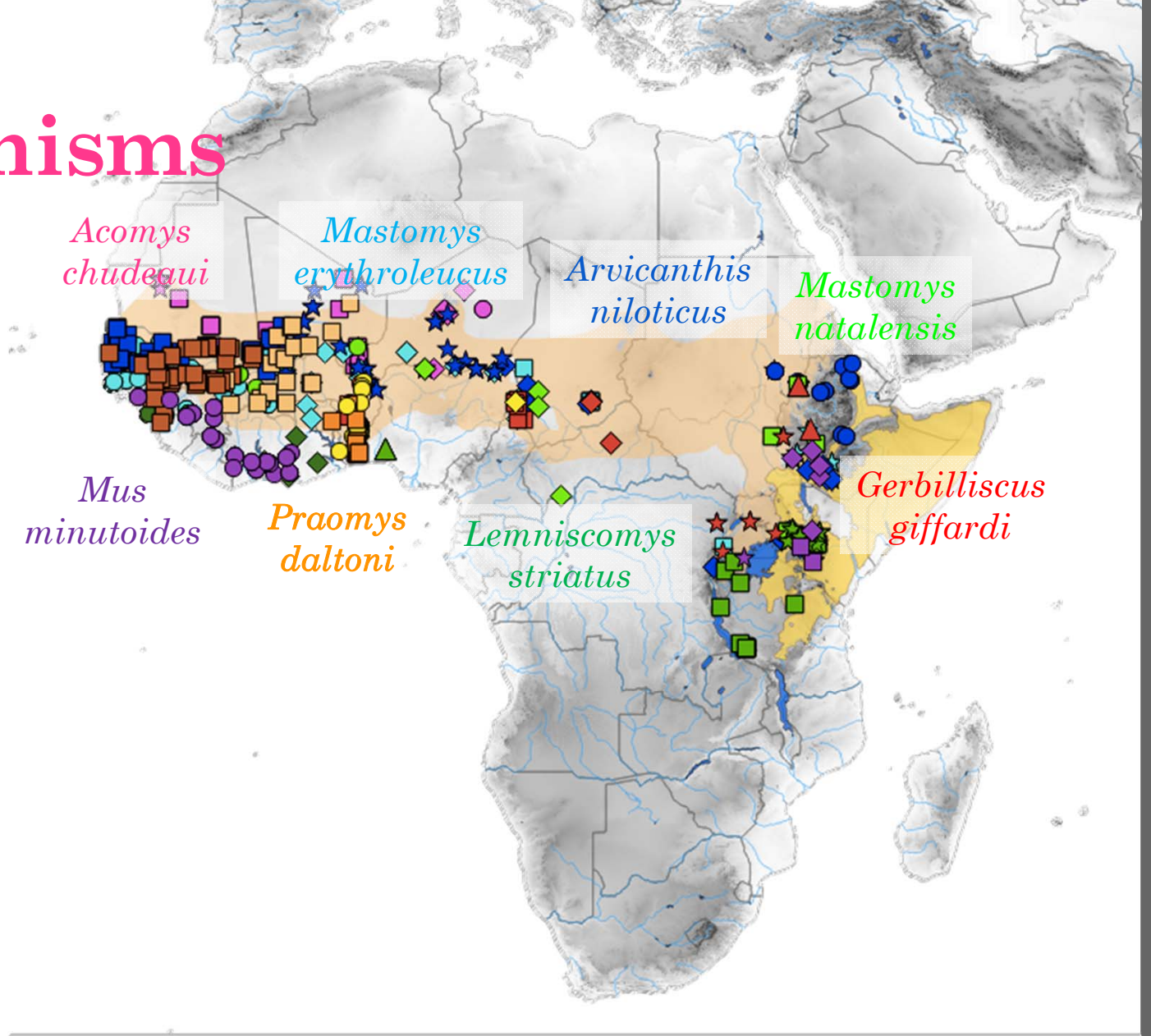
Model organisms

8 model organisms

Add more than 800 sequences

Constrain topology and divergence time

Coalescent prior based only on CYTB

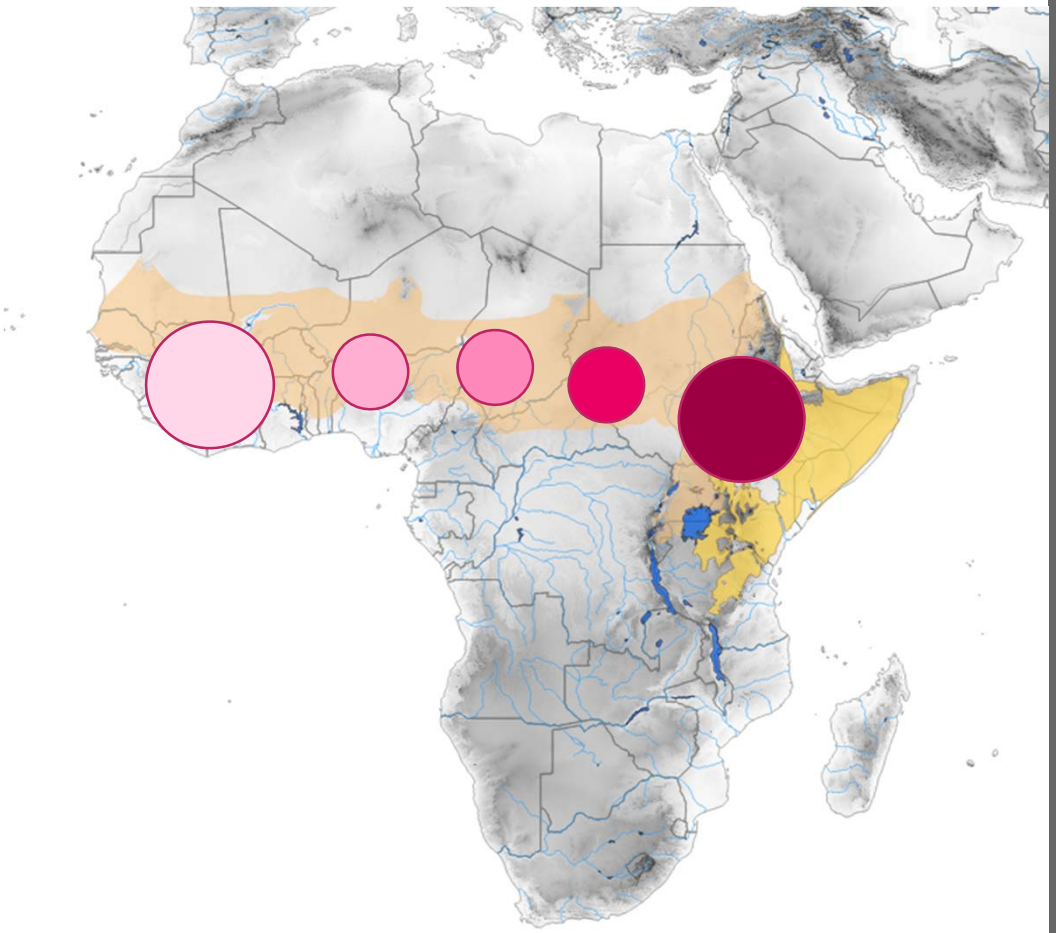


Aims

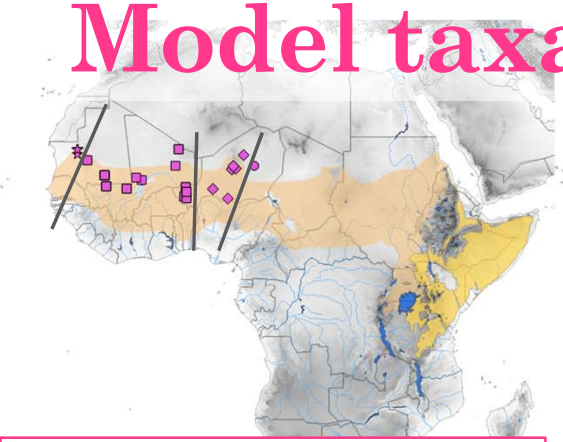
To identify absolute time of diversification rodents from Sudanian savanna

To detect synchrony between taxa

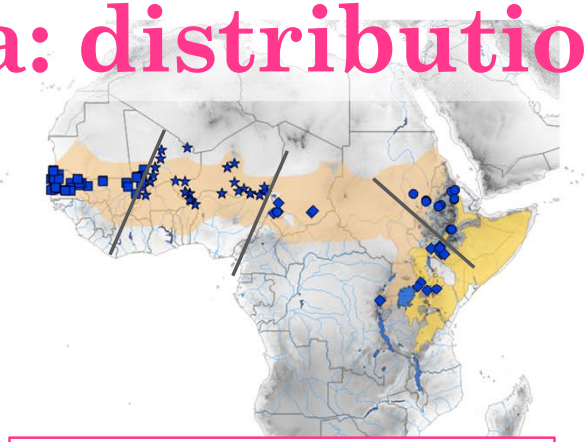
To identify phylogeography patterns



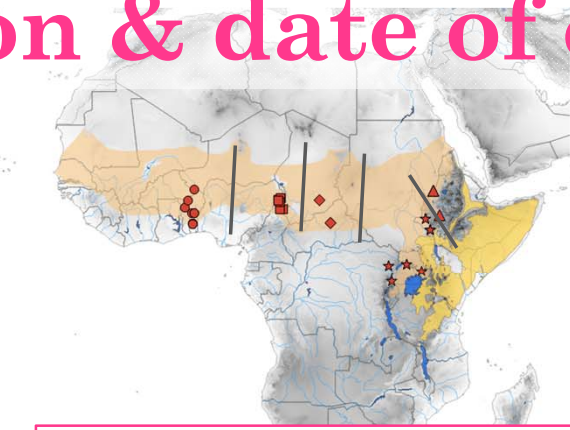
Model taxa: distribution & date of origine



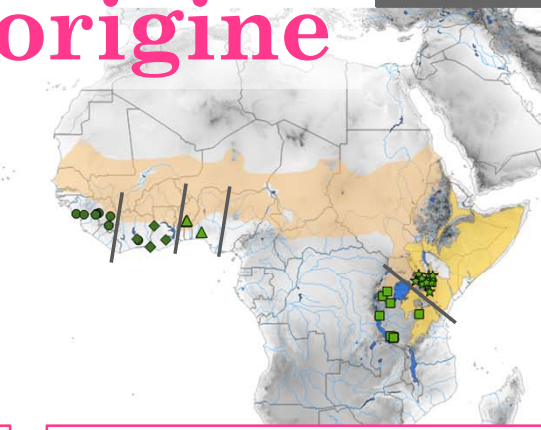
Acomys chudeaui
1.82 My



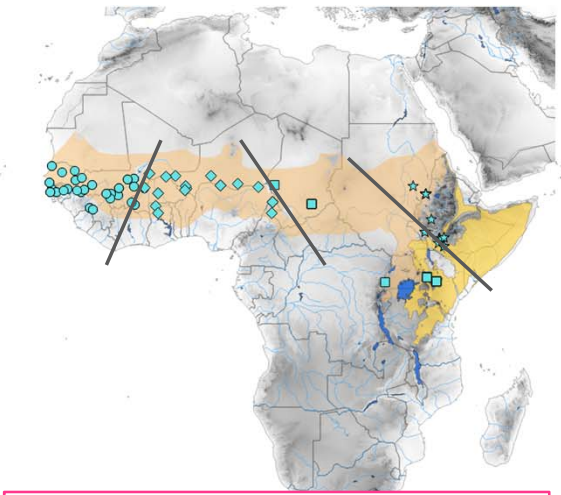
Arvicanthis niloticus
3.64 My



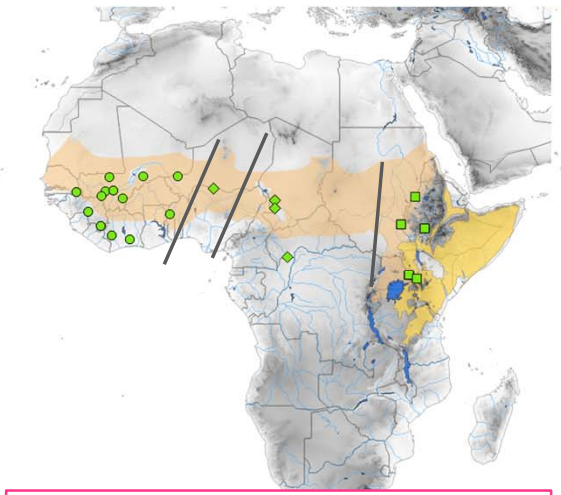
Gerbilliscus giffardi
4.43 My



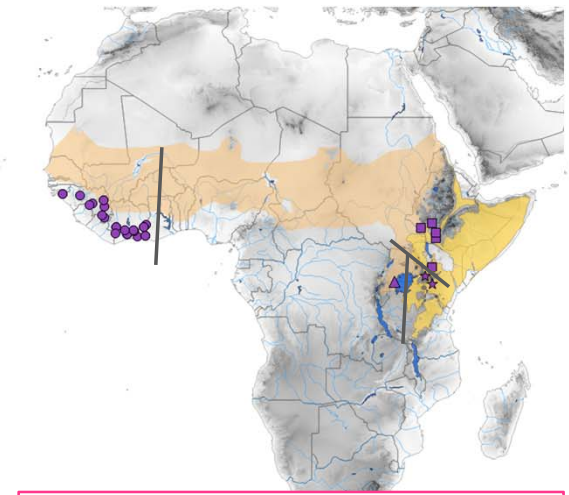
Lemniscomys striatus
4.2 My



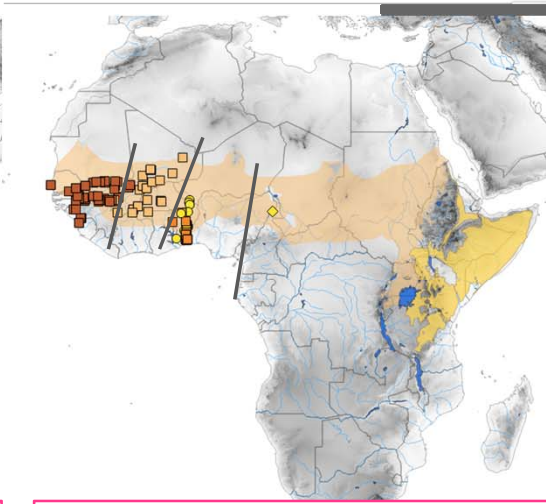
Mastomys erythroleucus
2.13 My



Mastomys natalensis
2.13 My

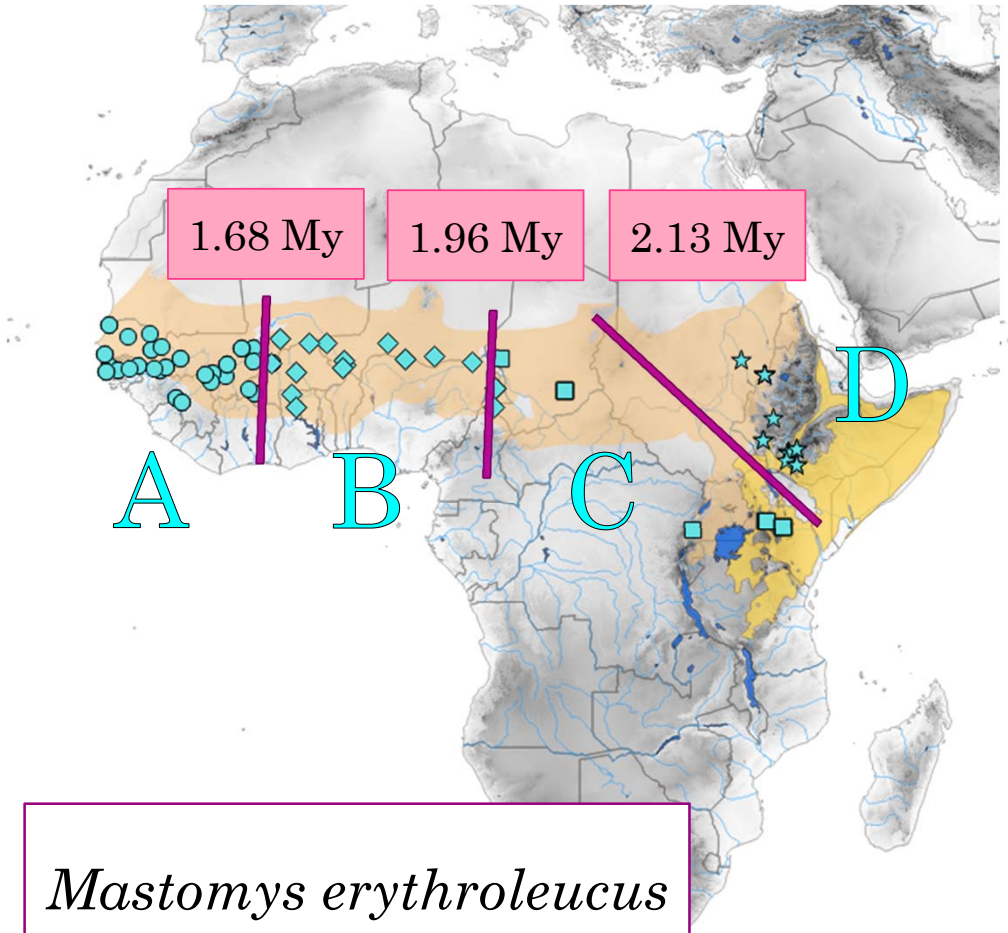


Mus minutoides
3.15 My

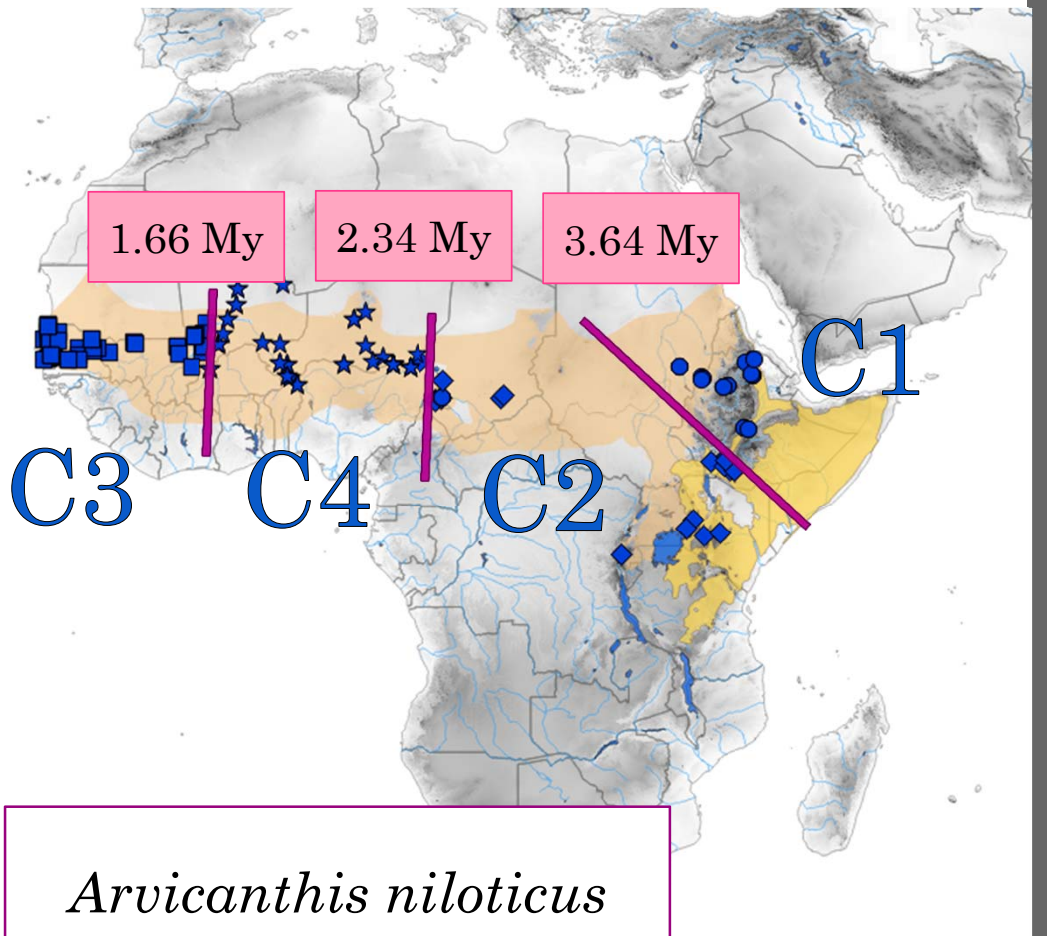


Praomys daltoni group
4.65 My

Similar pattern

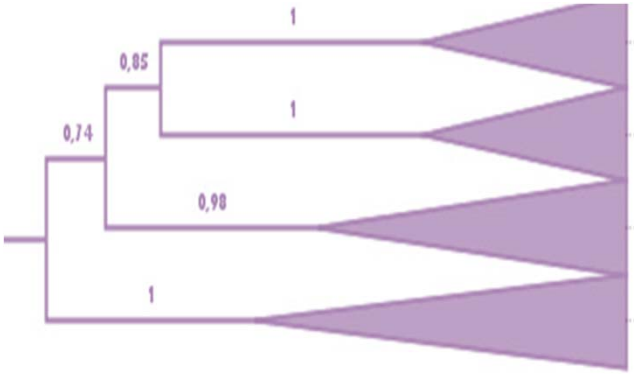


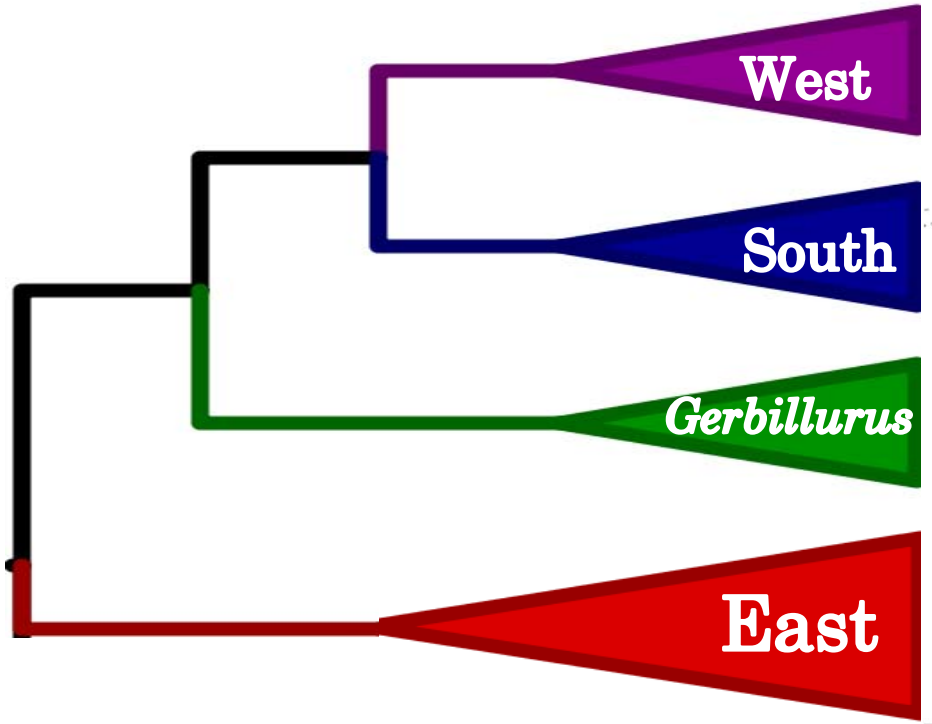
Mastomys erythroleucus

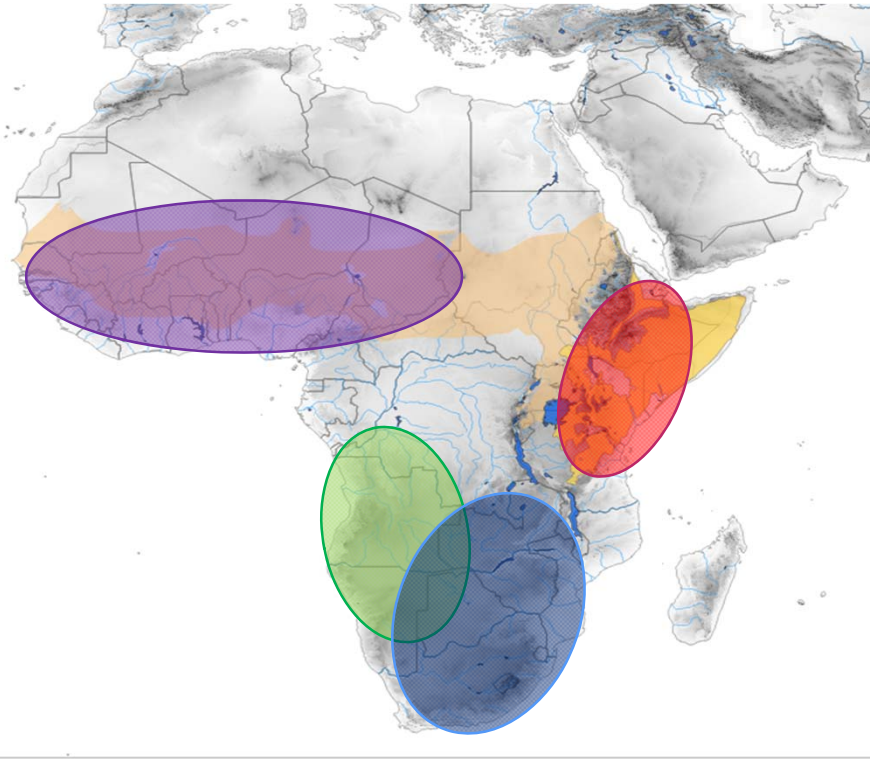


Arvicanthis niloticus

Genus *Gerbilliscus*

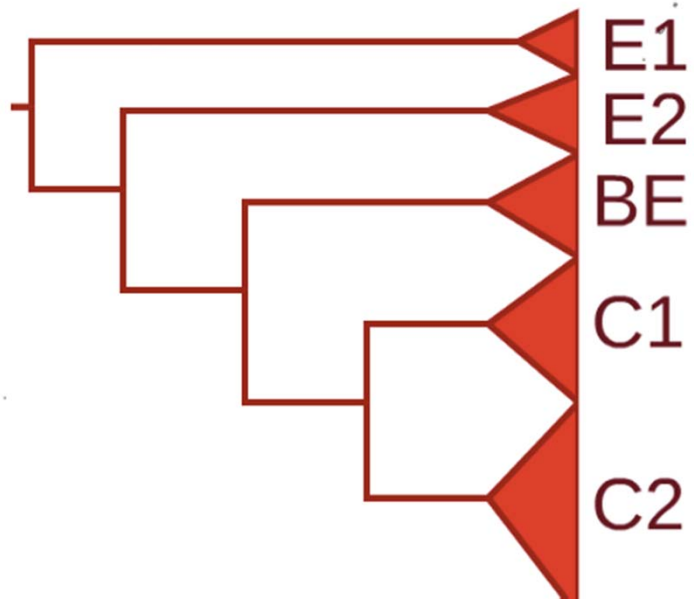


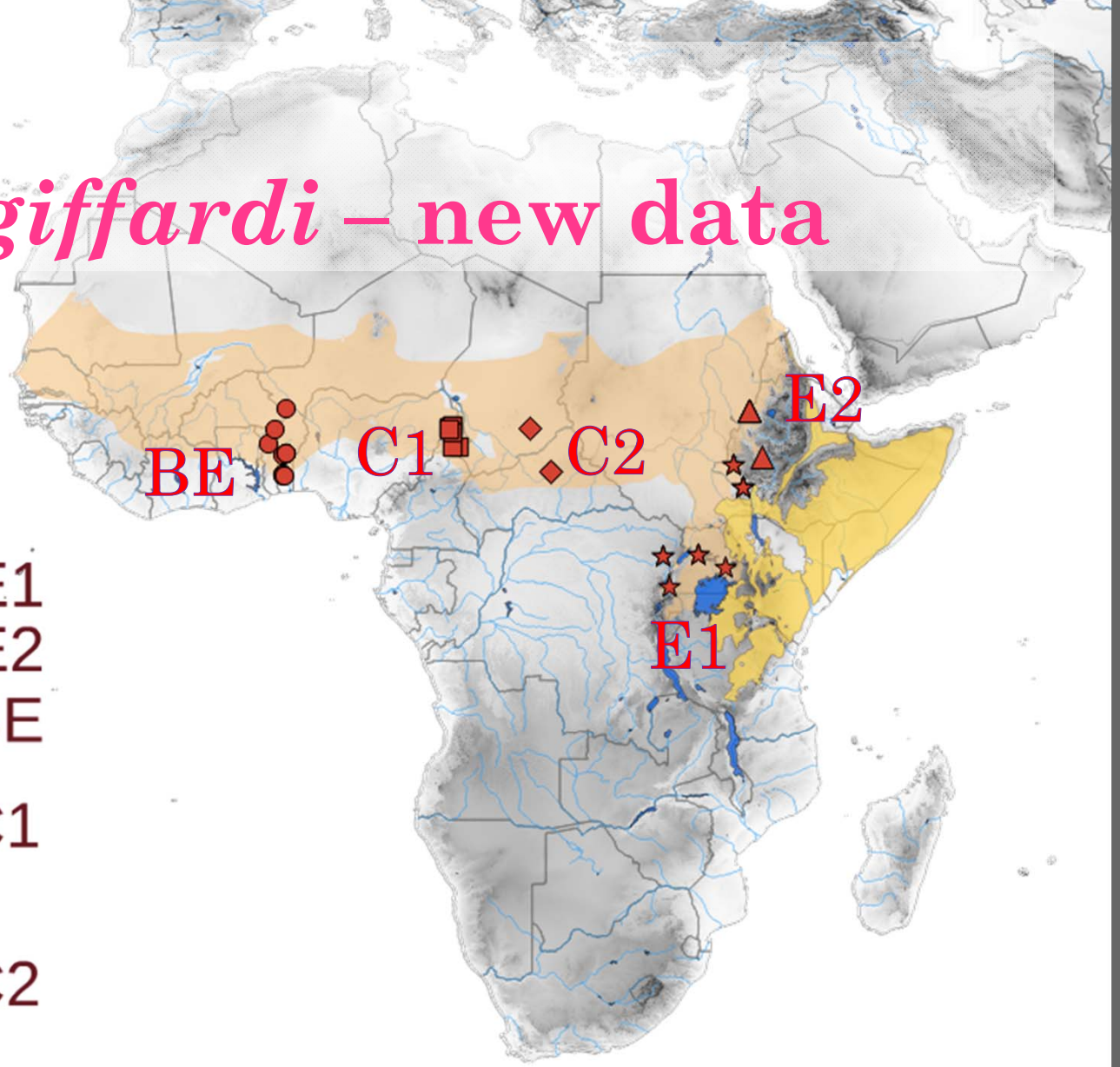




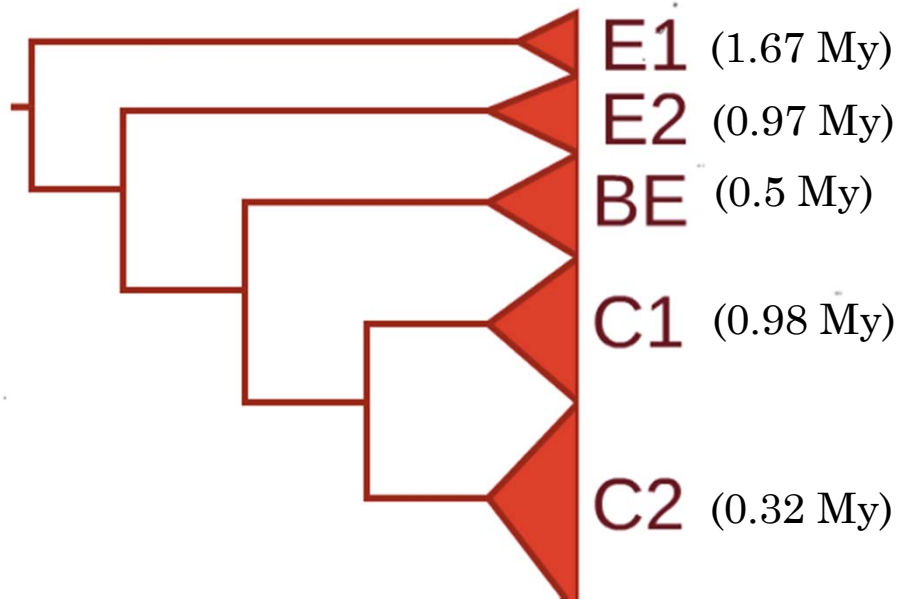
Gerbilliscus giffardi – new data

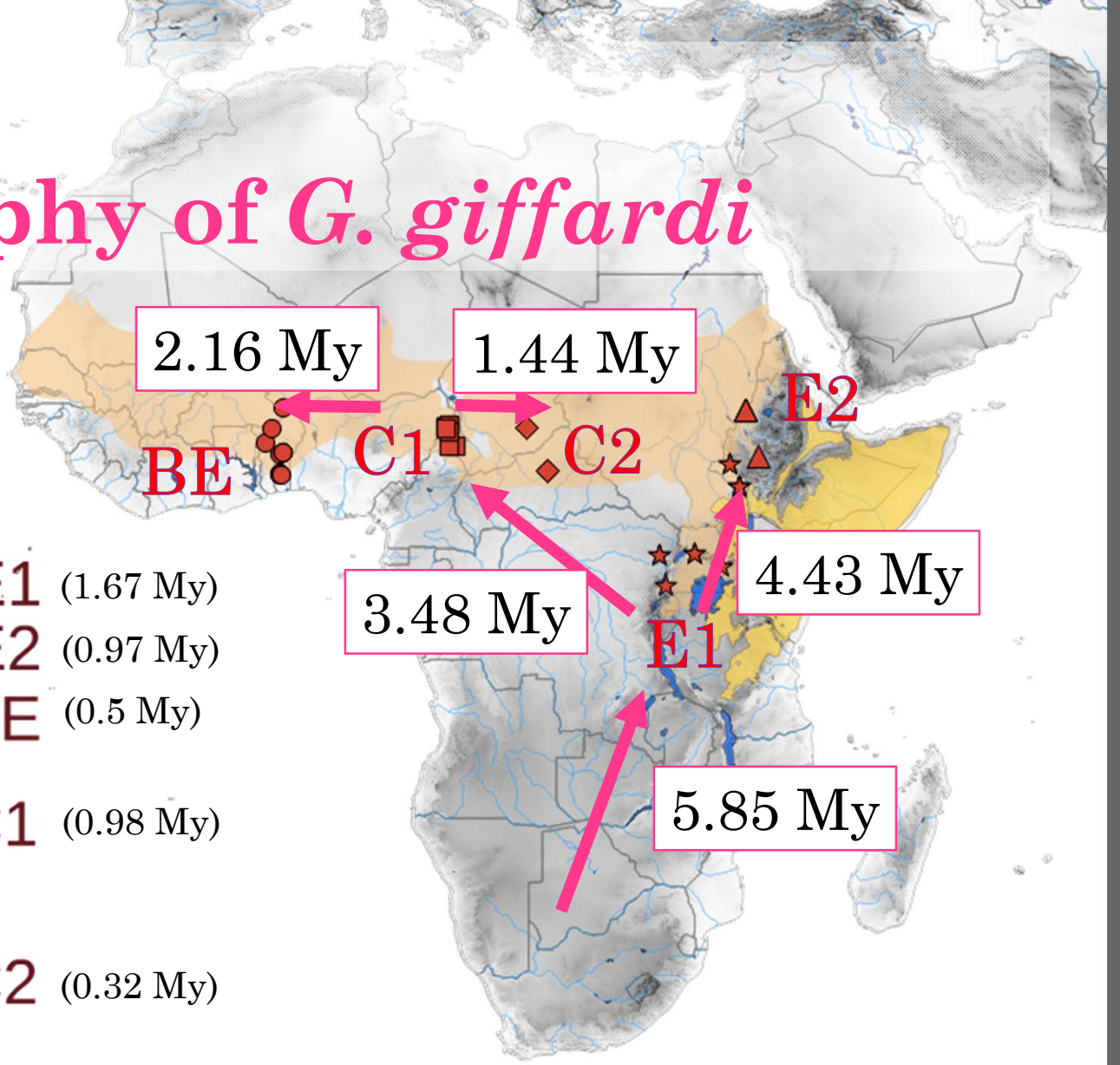
Granjon et al. (2012)





Phylogeography of *G. giffardi*



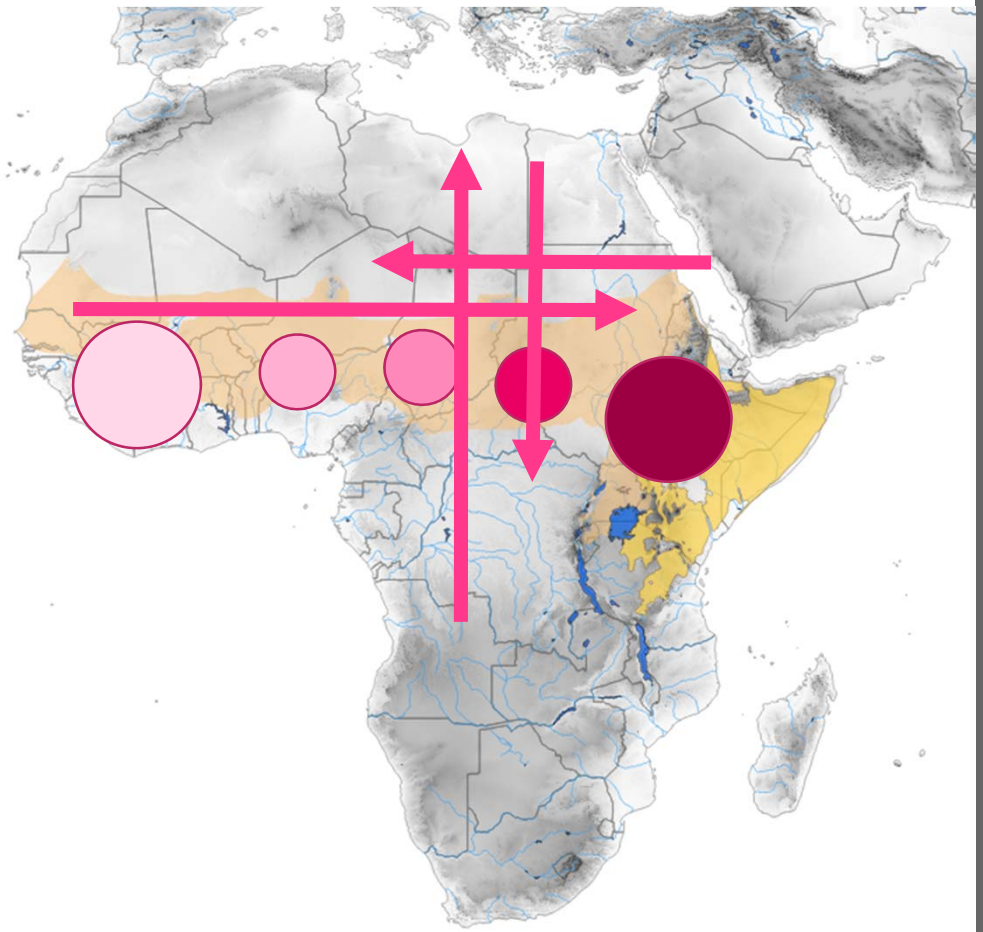


Conclusions

Phylogeography is complex

Ecological analysis needed

Current distribution only history snapshot



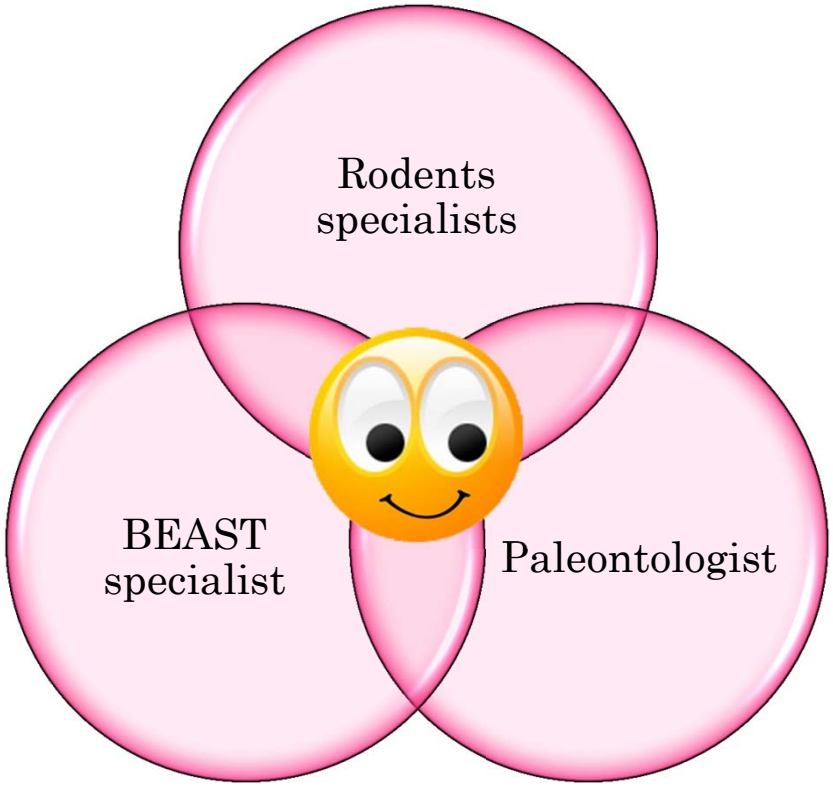
Take home message…

Multilocus phylogeny of Muridae

Valid fossil records

Divergence analysis “all-in-one”

Comparative phylogeography



Thank you for your attention.

Any questions???

Acknowledgment

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