Cross Species Quantitative Microglia Branching Analysis

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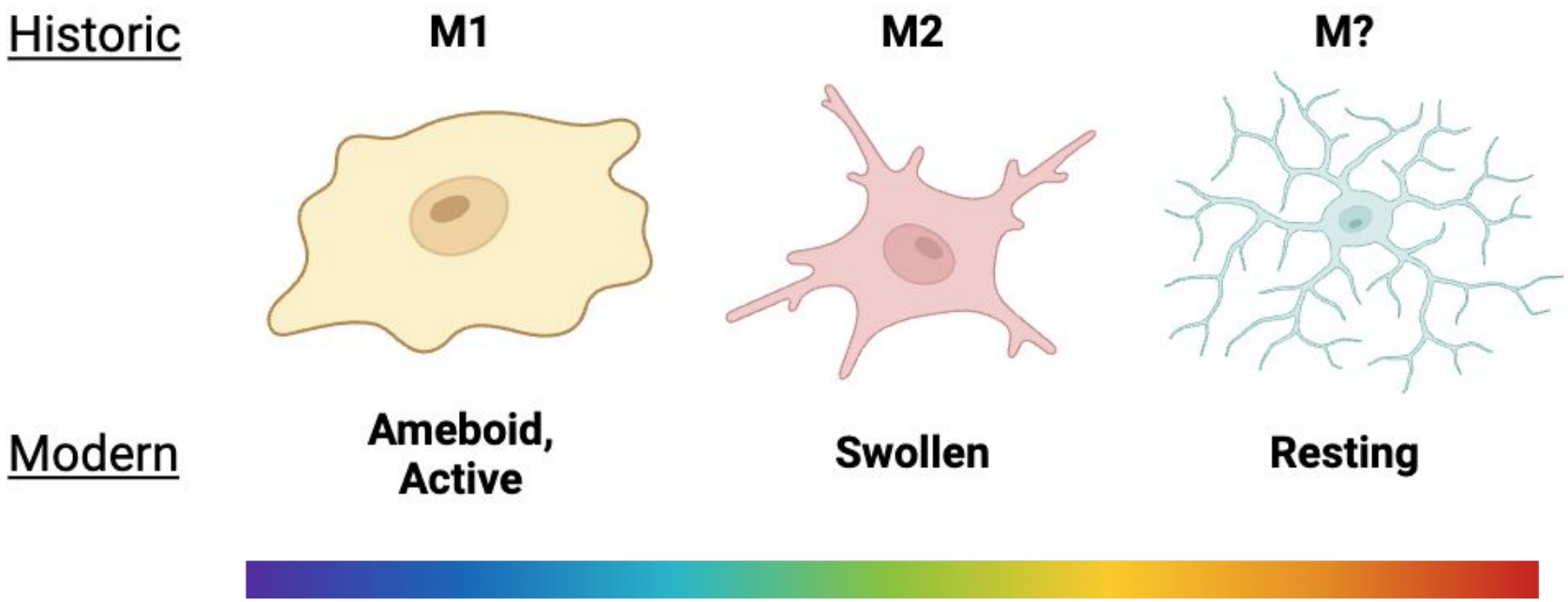
What are microglia? What is cell morphology?

Resident Immune Cells of the Brain

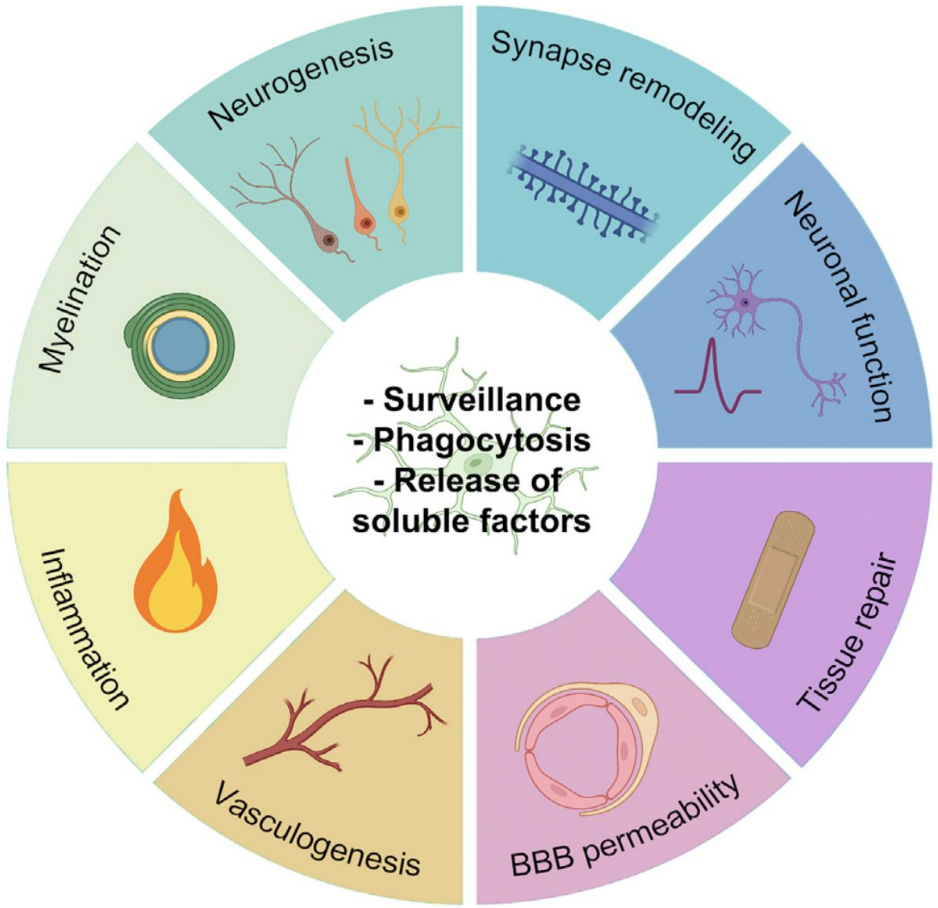


Changes shape depending on the health of the environment

Created with BioRender.com

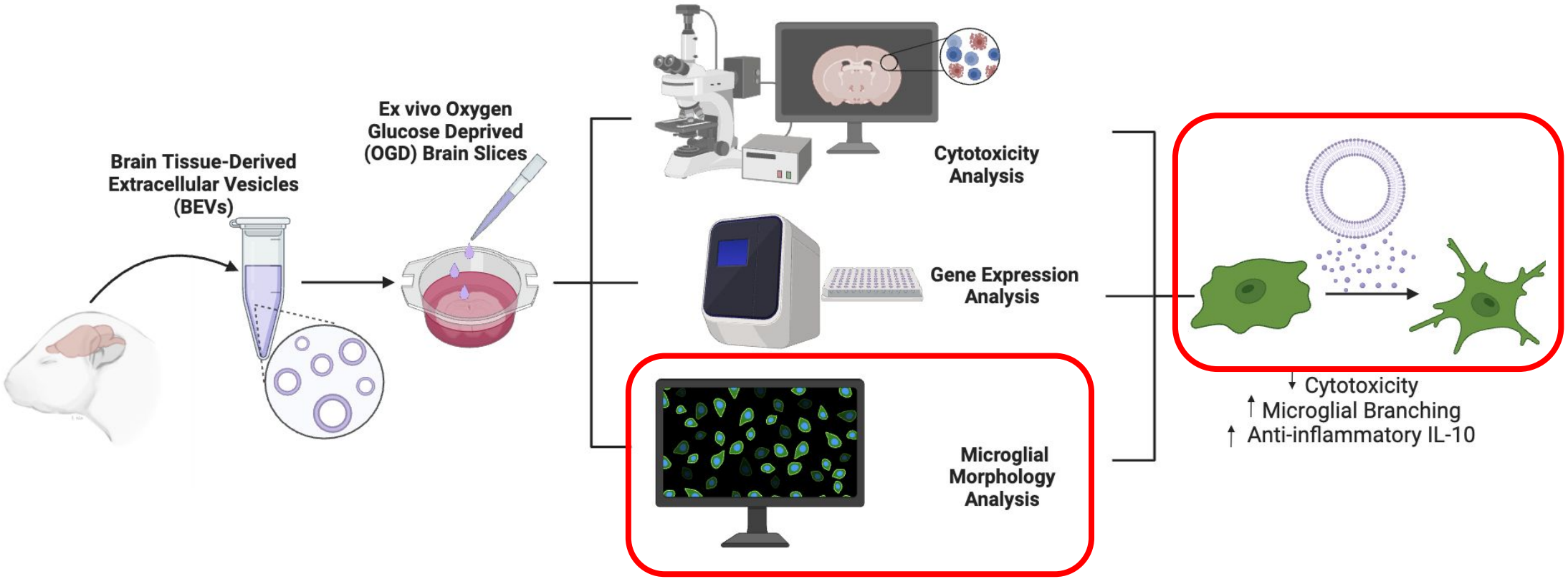
What are microglia important?

Microglia Morphology can tell us the effectivity of treatment according to factors such as cytotoxicity.



Paolicelli RC, et al. . Neuron. (2022) doi: 10.1016/j.neuron.2022.10.020

What does microglia morphology show us?



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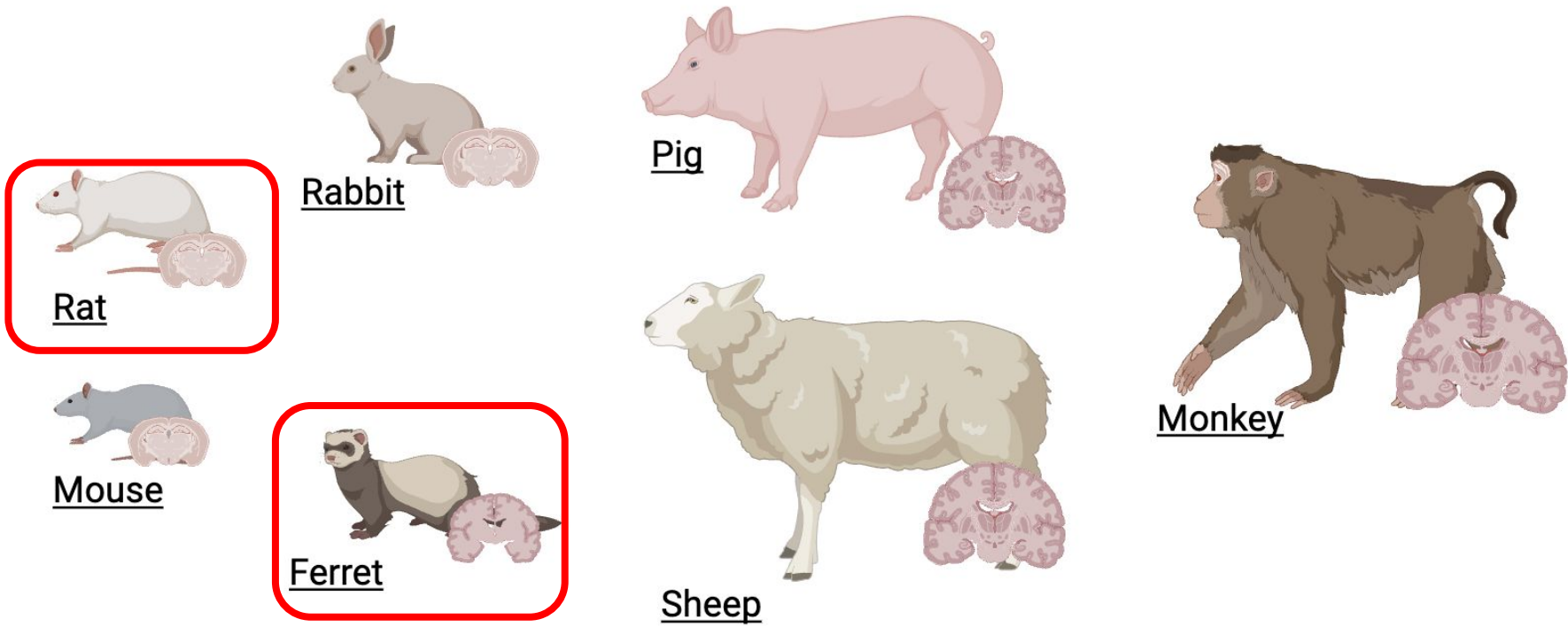
How do we research microglia?

Utilizing animal models, we are able to find possible therapeutics for diseases which also applies to humans!



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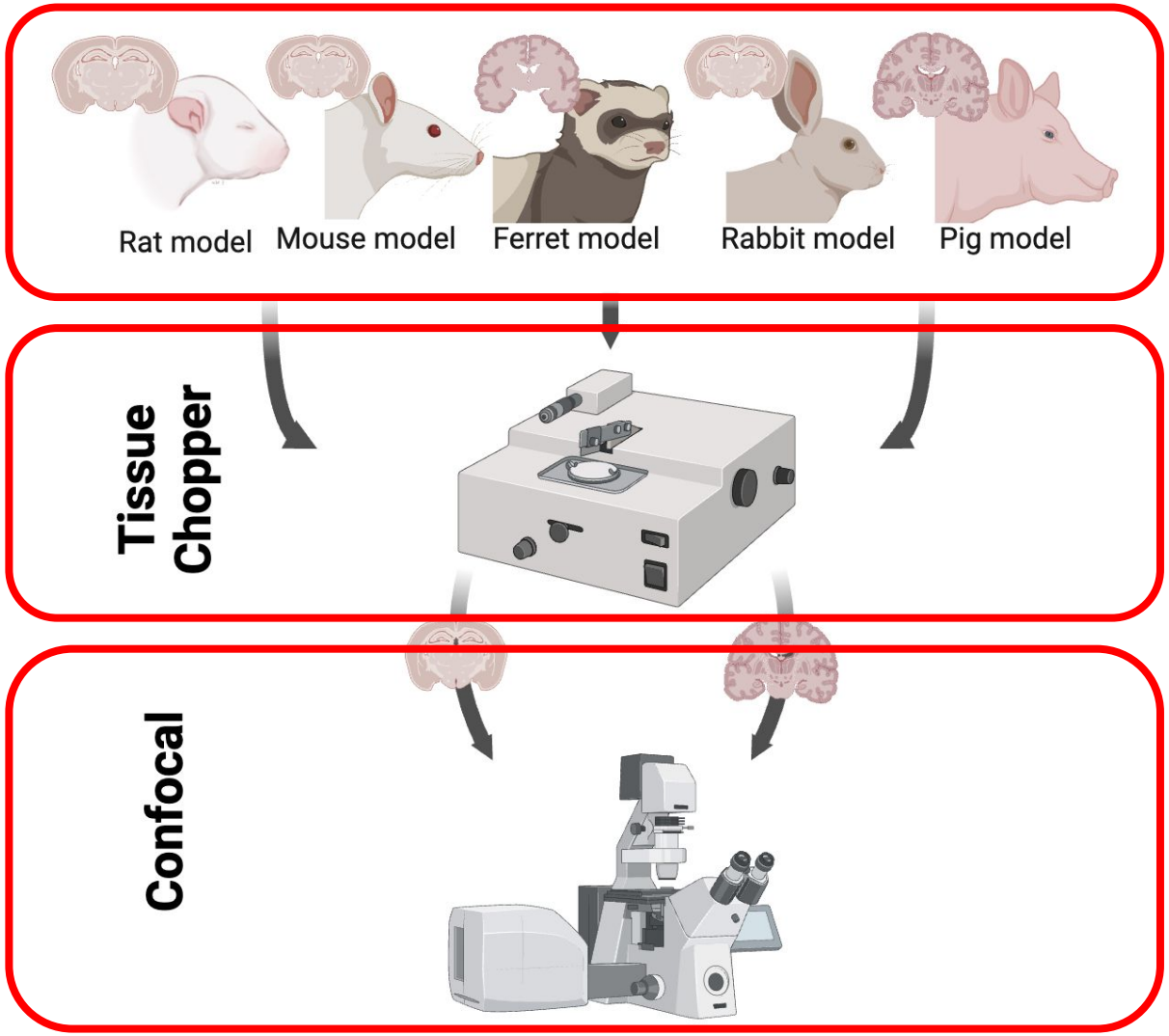
With so many animal models used throughout the field, are there any variances in microglia morphology cross-species?

How do we extract microglia?

+ other collaborators



All Healthy Animals

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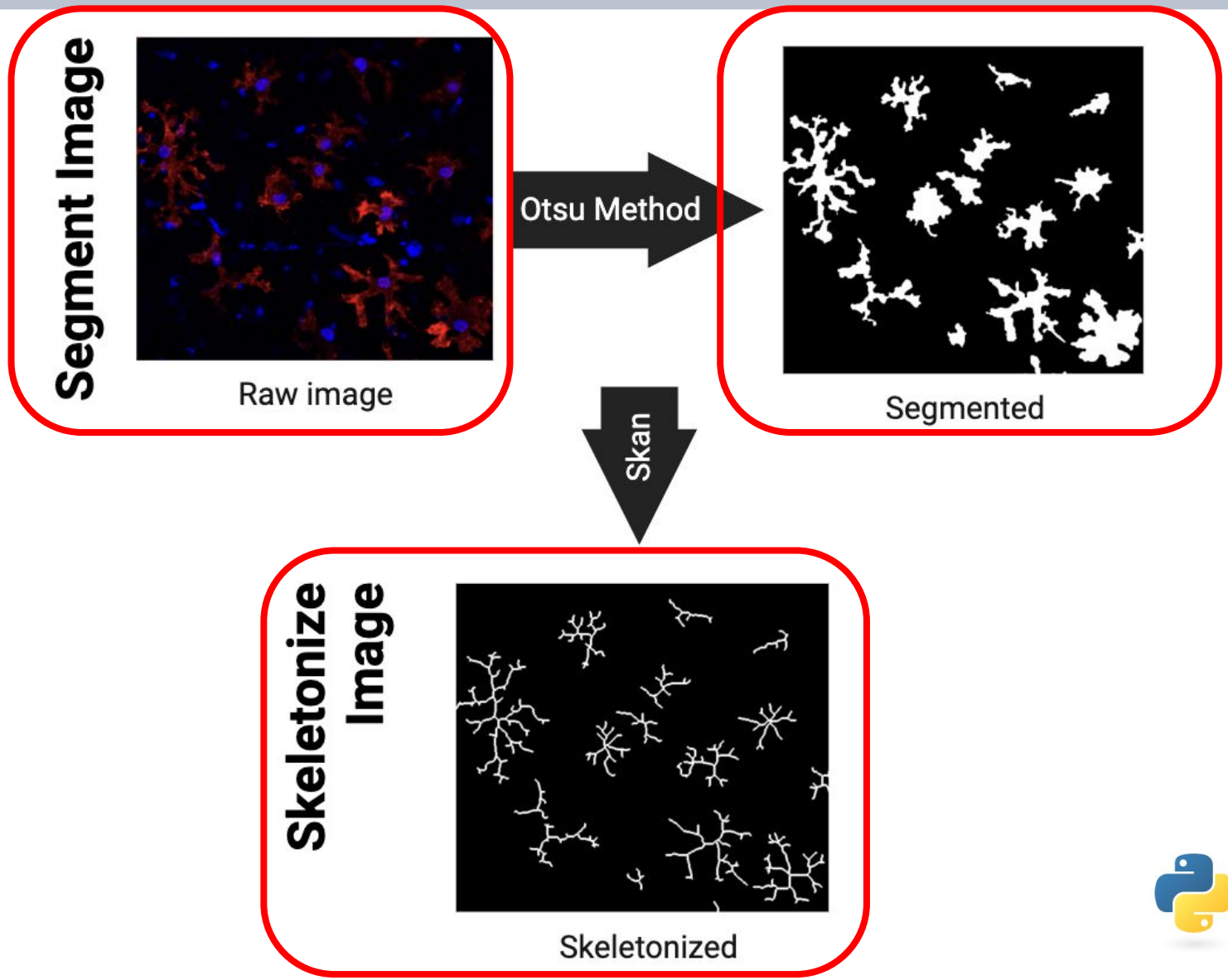
How do we quantify microglia morphology?



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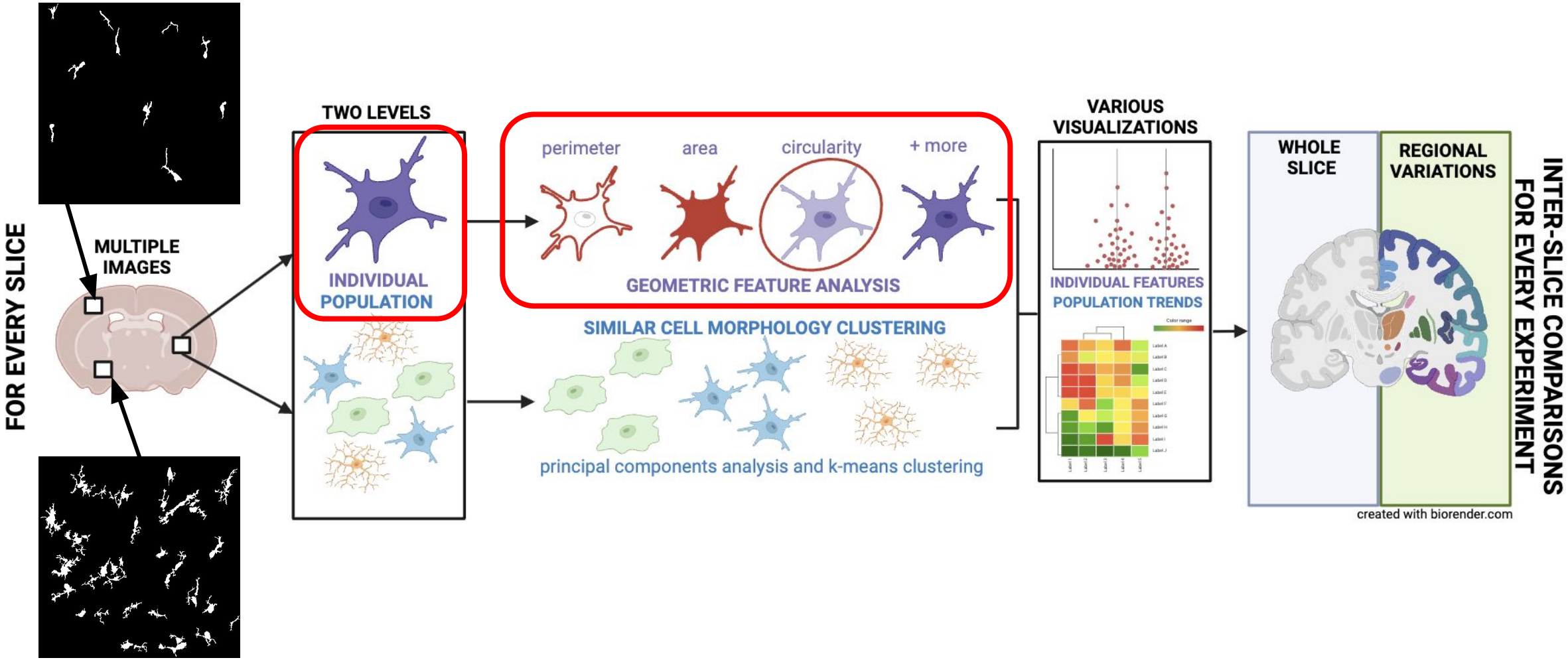
What can we get from these images?



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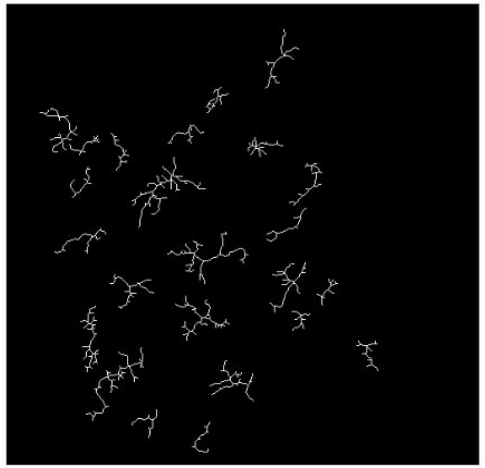
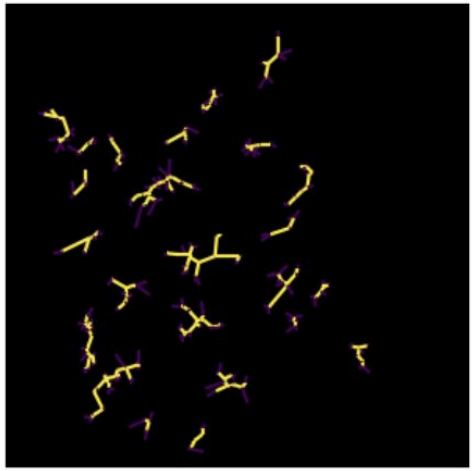
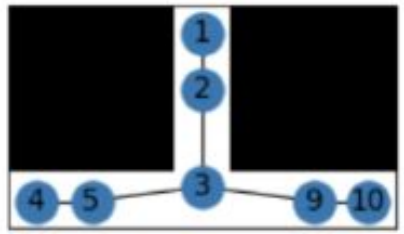
What can we get from these images?

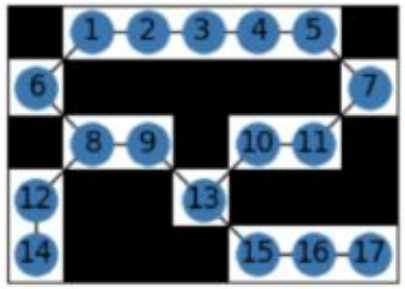
Skeletonized Image

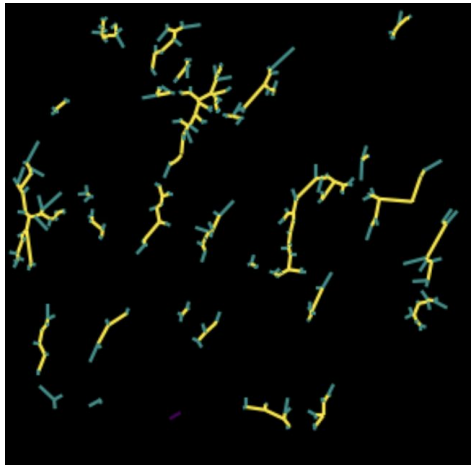


Branch Distance According to Branch Type









Branch Types

Distance

0 Endpoint — Endpoint

1 Junction — Endpoint

2 Junction — Junction

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What can we get from these images?

Mainly highlighting:

Highlight regions with differences most seen in:

species combined

rat, mouse, ferret, rabbit, pig

not separated based on age and sex

sexual maturity equivalent

rat, mouse, rabbit, pig

not separated based on sex

P70 P45 P22 P220

neonatal equivalent

rat, mouse, ferret, pig

not separated based on sex

P13 P12 P21 P23

P = postnatal day

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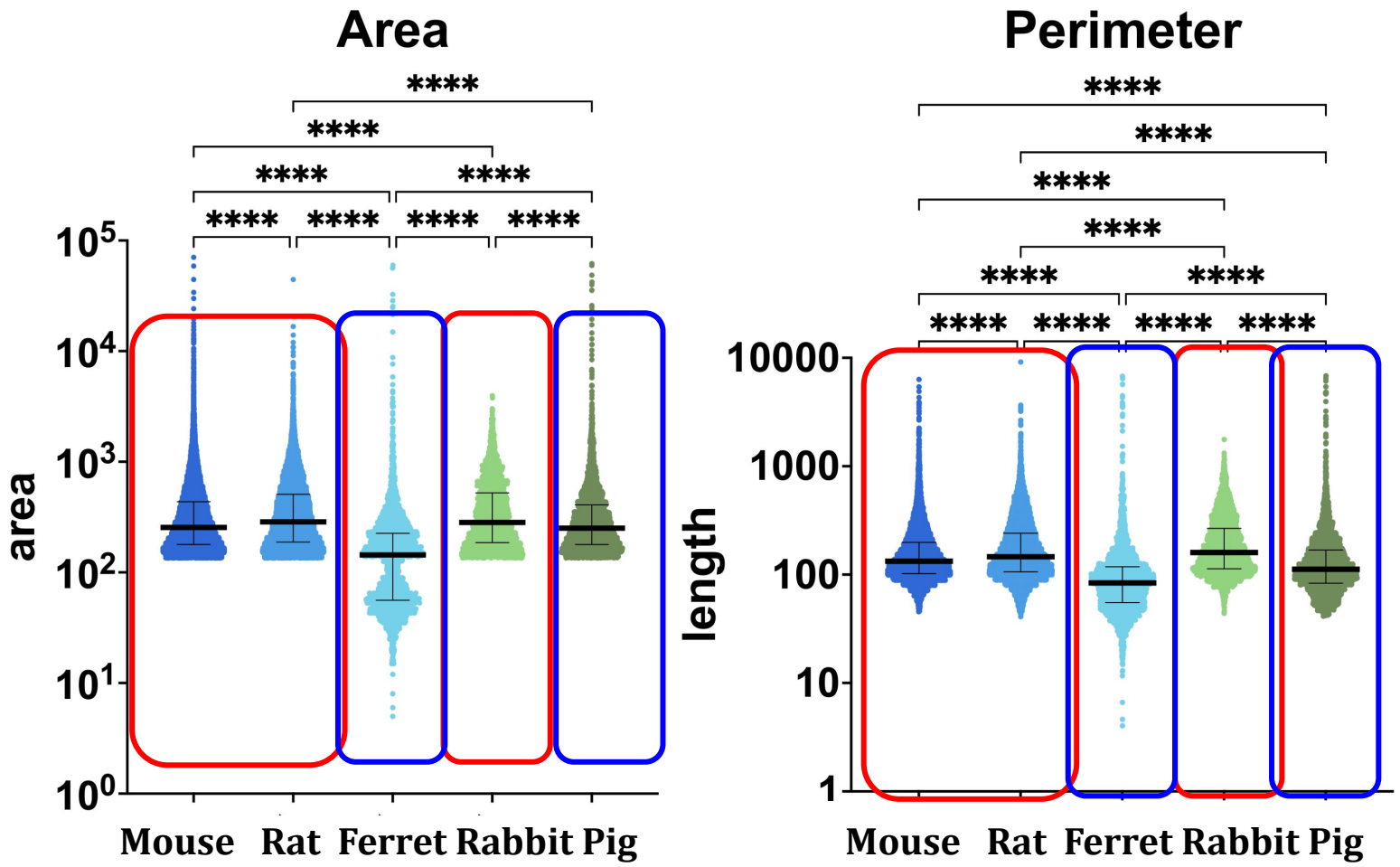
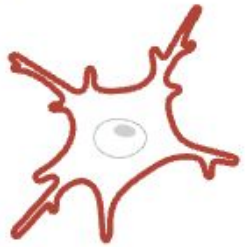
What are the differences between species in terms of size?

area



perimeter

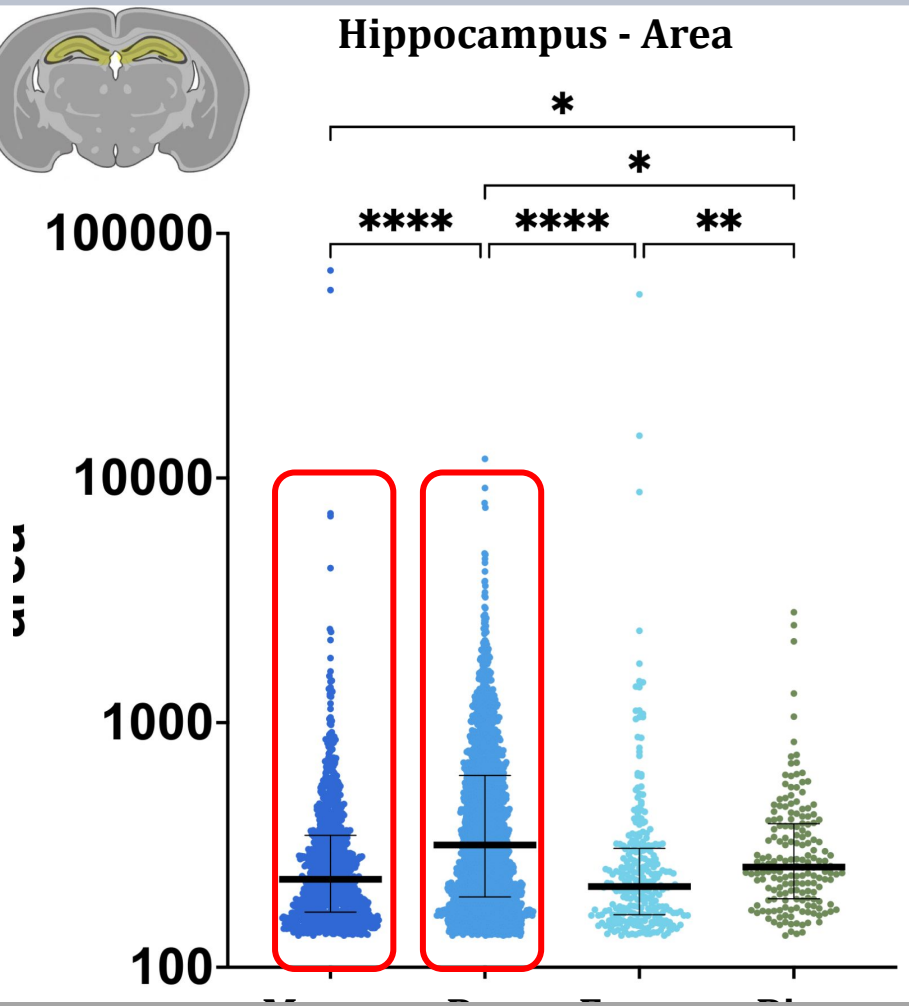


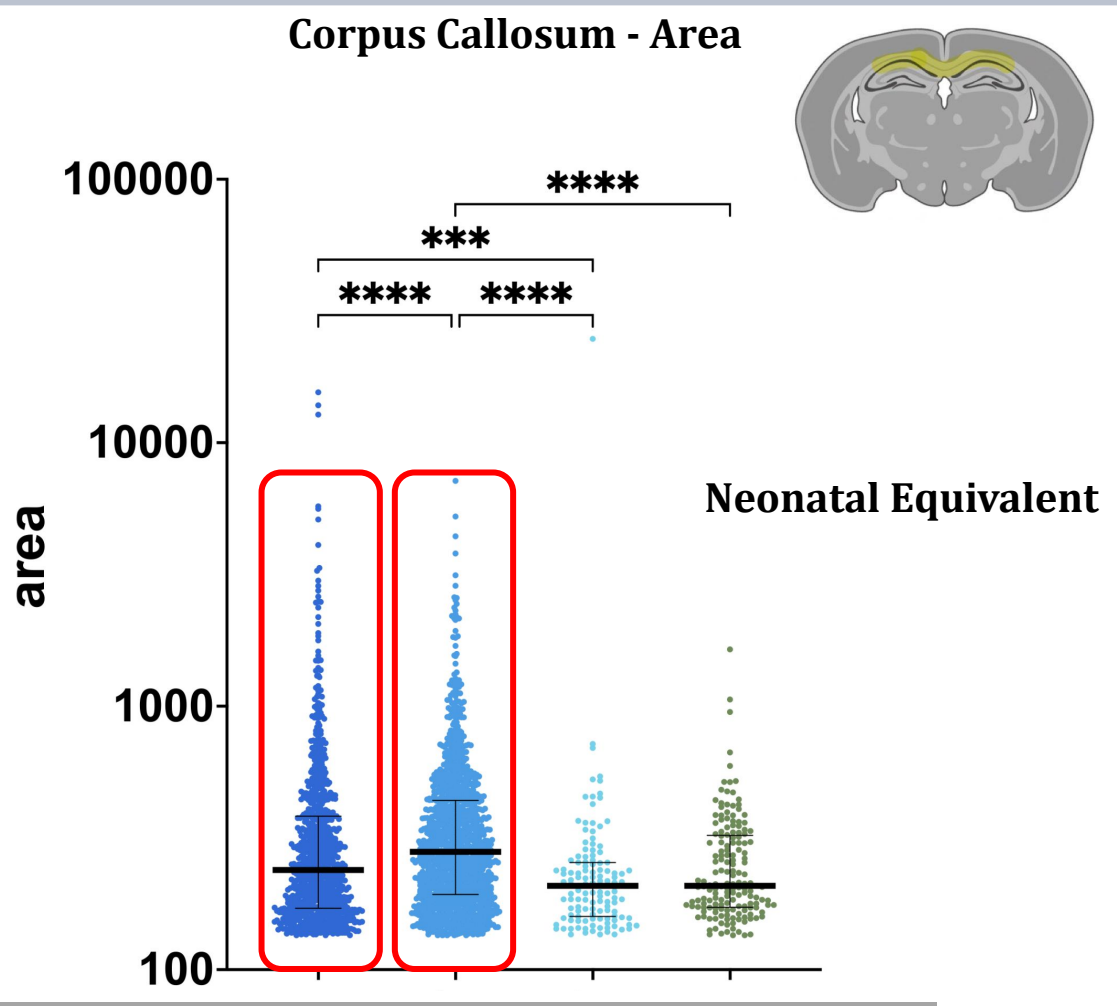
Mouse, rat, and rabbit are more branched out or larger

units in pixels - scaled with log10 for visibility

*(p<0.05), **(p<0.01), and ***(p<0.005) ****(p<0.001) indicate significant differences with Kruskal-Wallace test.

What are the differences between regions in terms of area?

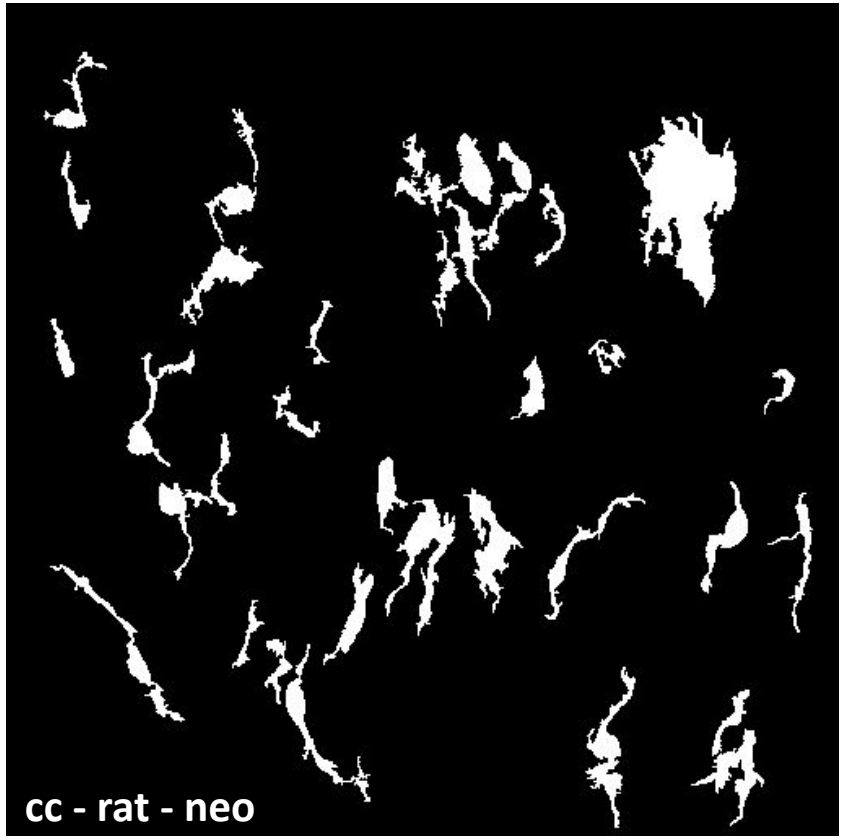


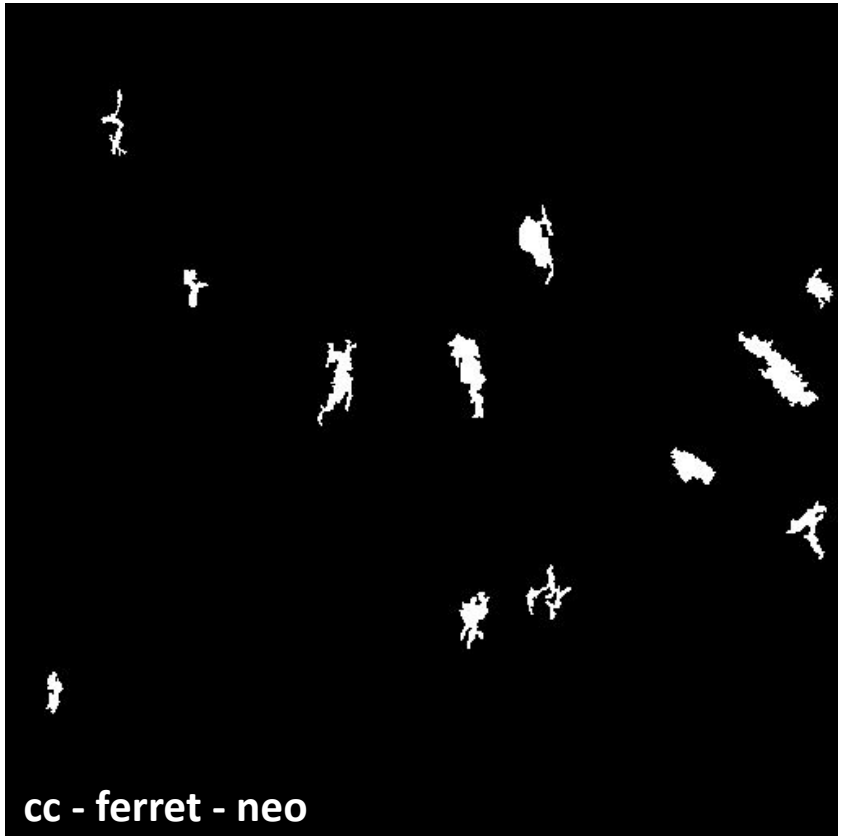


Neonatal eqv mouse and rat in most regions are larger in area than ferret and pigs

*(p<0.05), **(p<0

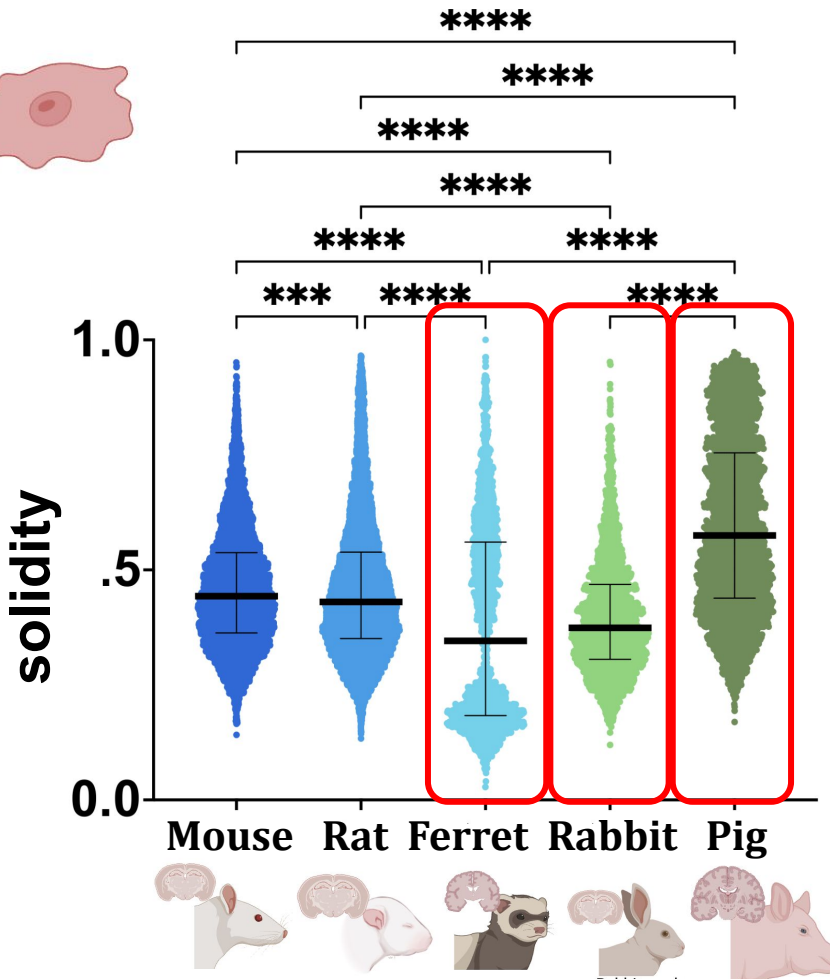
What are the differences between regions in terms of area?

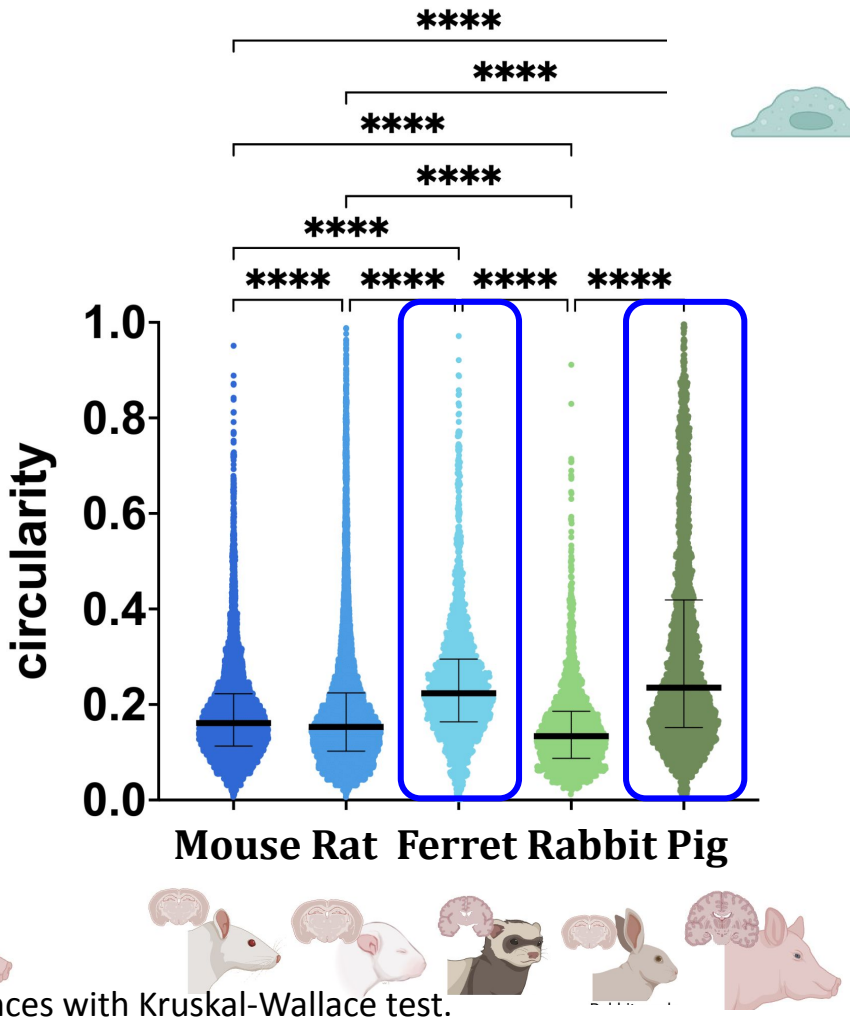




Pigs are most area-dense while ferrets are the least dense. However, they similar in circularity.

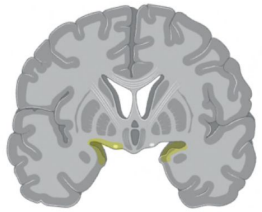
What are the differences between species in terms of shape?

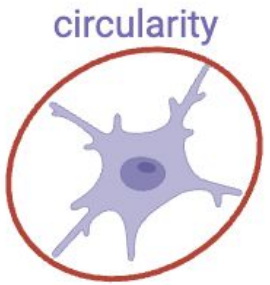


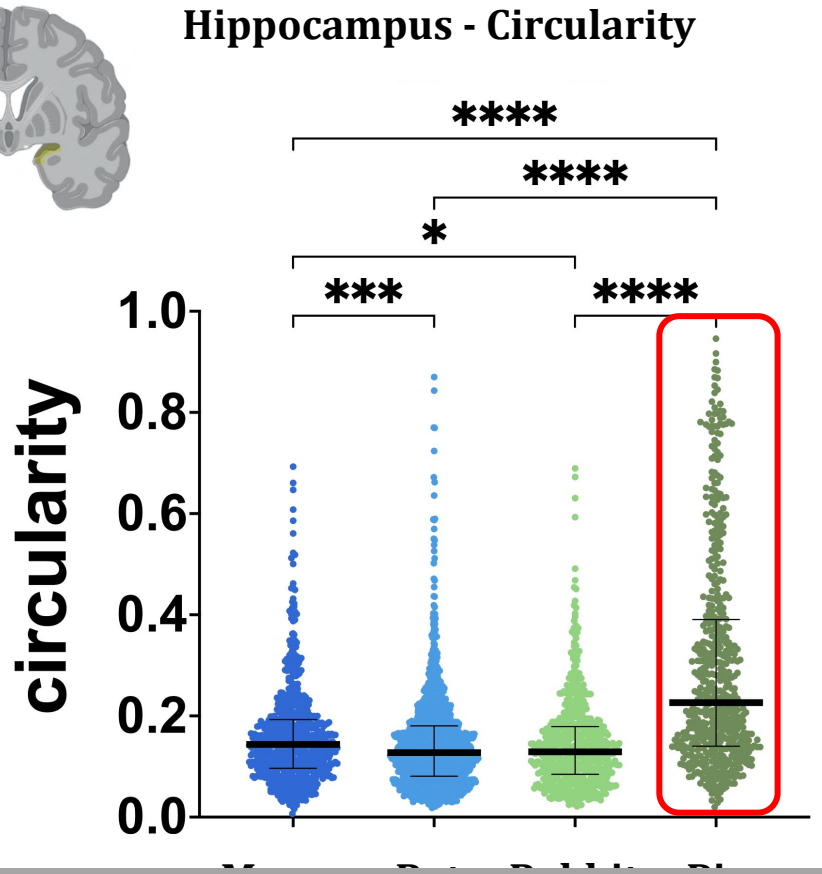


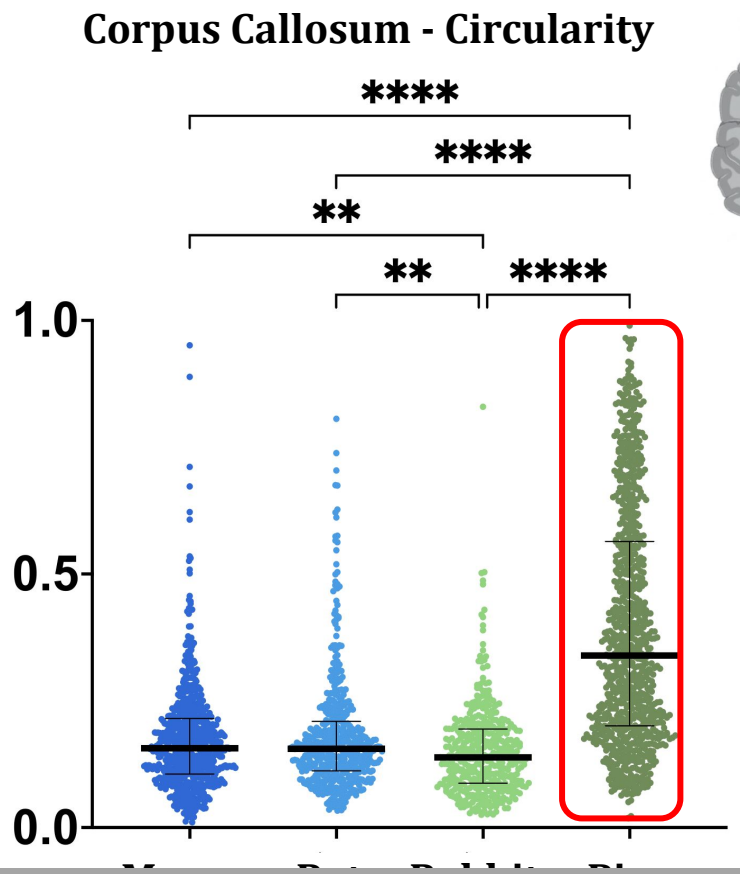
*(p<0.05), **(p<0.01), and ***(p<0.005) ****(p<0.001) indicate significant differences with Kruskal-Wallace test.
units in pixels - scaled with log10 for visibility

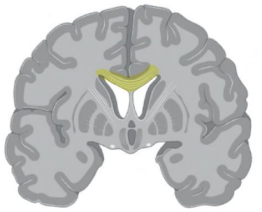
What are the differences between regions in terms of circularity?









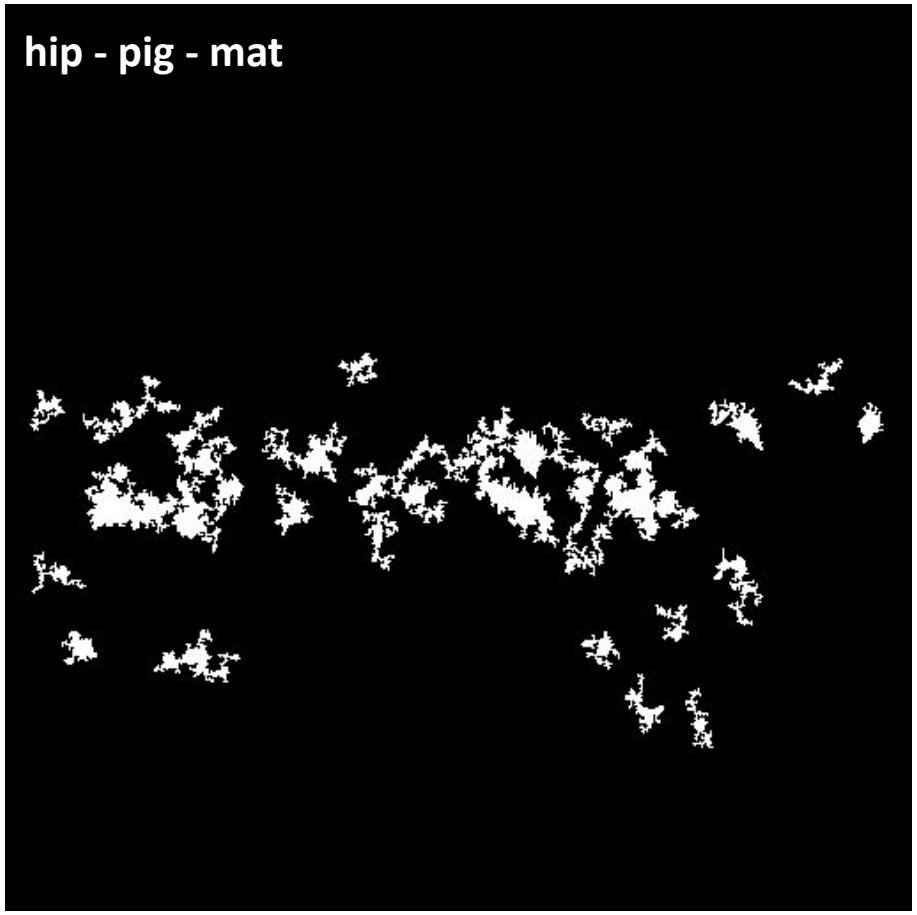


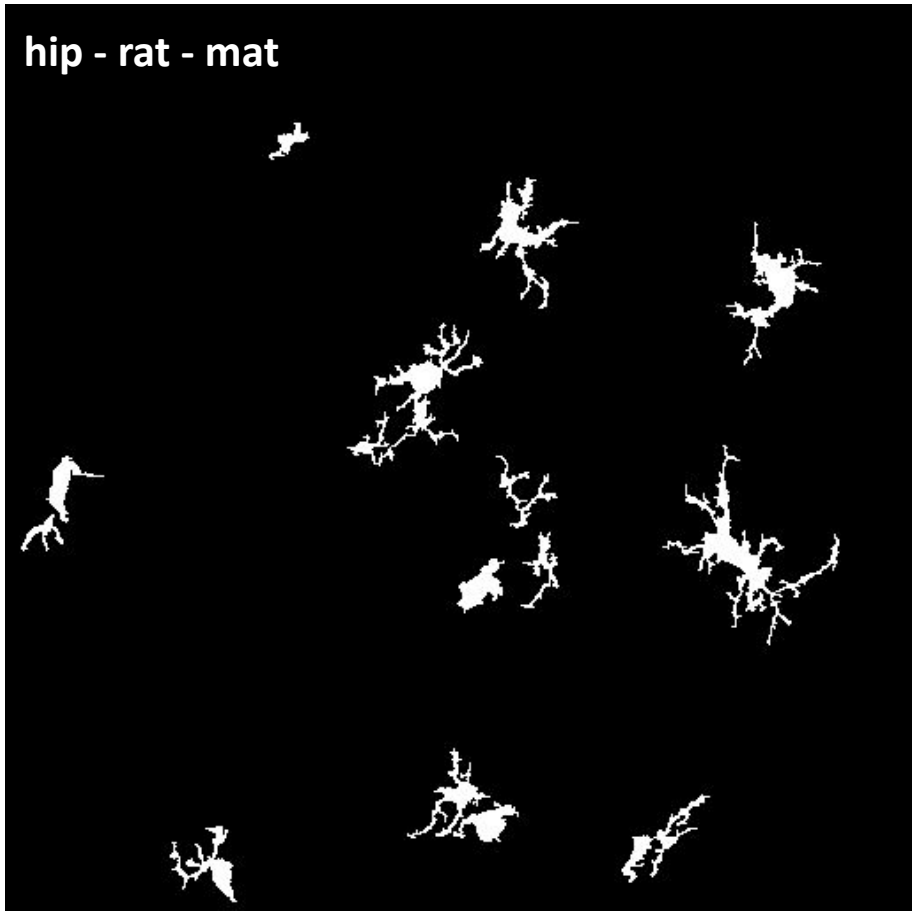
Maturity Equivalent

Maturity eqv pigs are the most circular compared to maturity eqv mouse, rat, and rabbit.

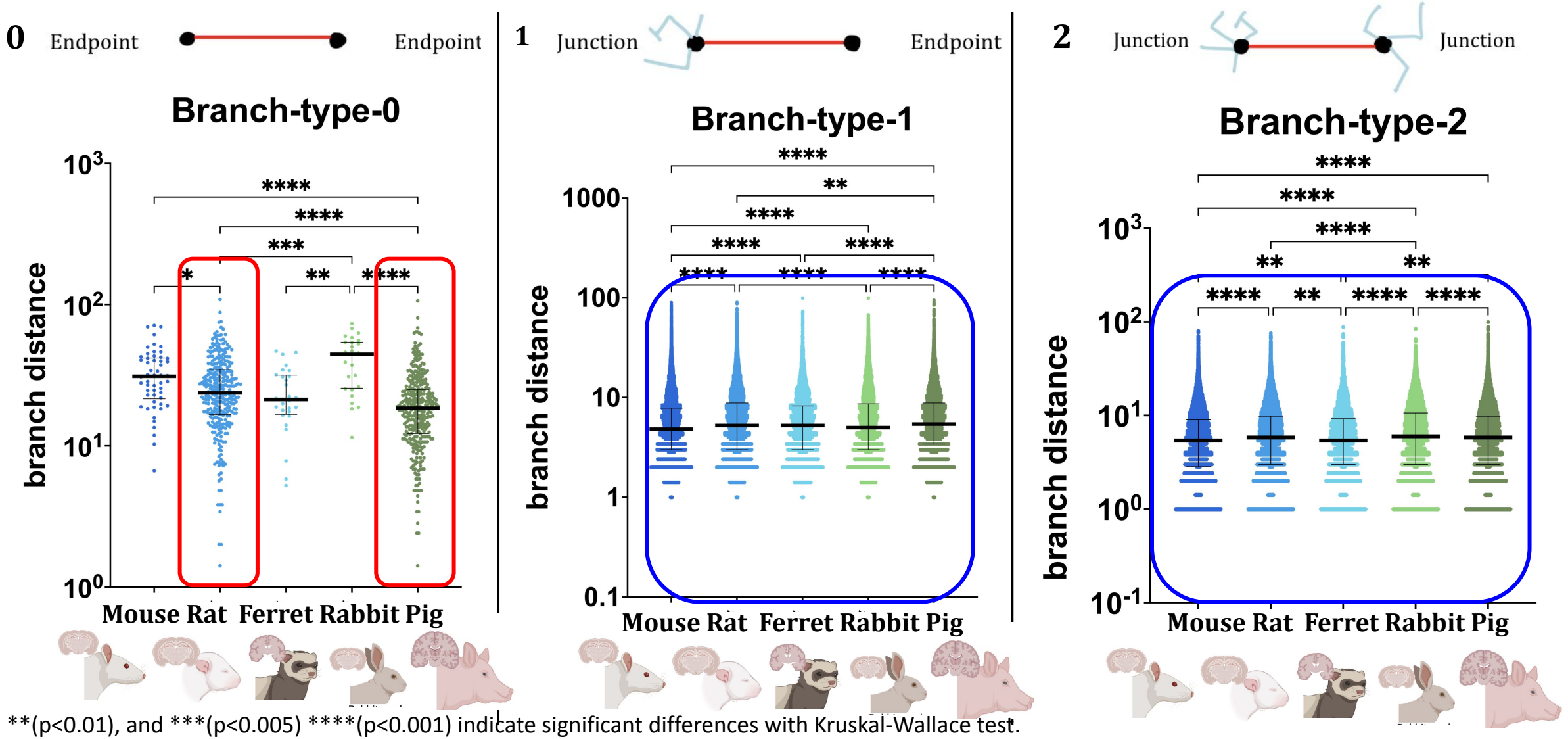
*(p<0.05), **(p<0.01), and ***(p<0.005) ****(p<0.001) indicate significant differences with Kruskal-Wallace test.

What are the differences between regions in terms of circularity?





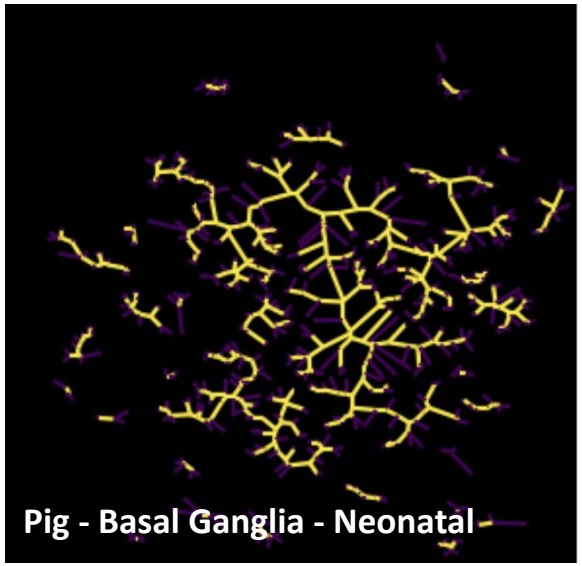
Rat and Pig have the most type 0 branches, which may lead to less branch complexity.
Branch type 1 and 2 lengths are similar across species.

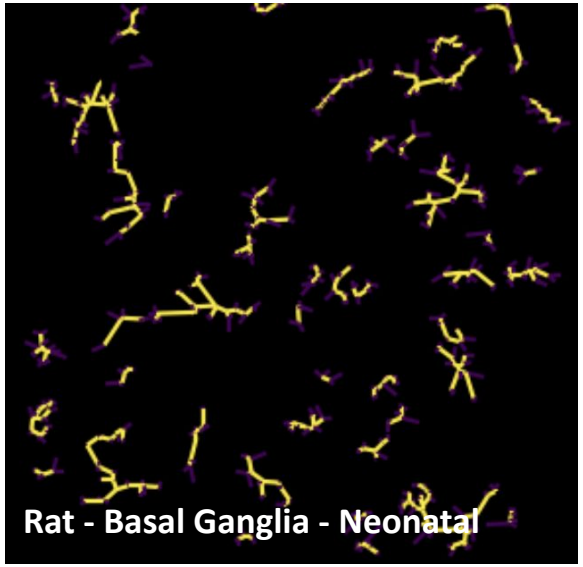


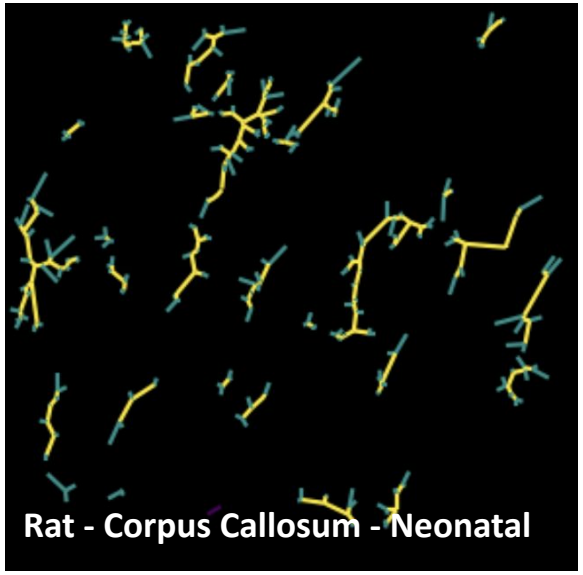
*(p<0.05), **(p<0.01), and ***(p<0.005) ****(p<0.001) indicate significant differences with Kruskal-Wallace test.
units in pixels - scaled with log10 for visibility

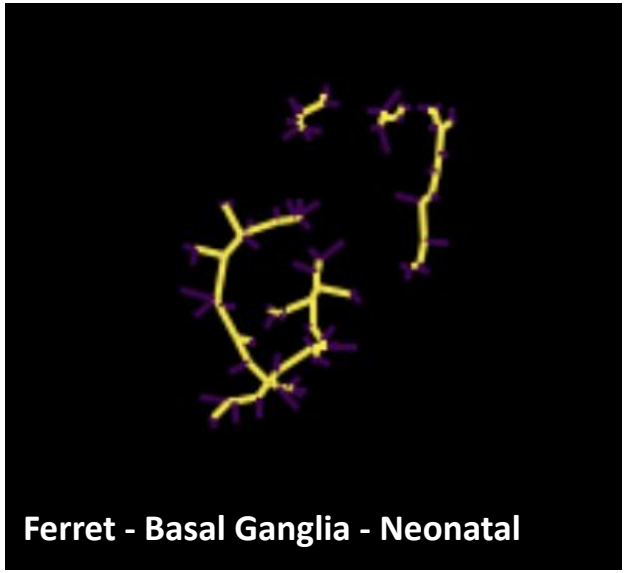
Next Steps

Branching is highly divergent, in the future would like to look further into the significance within branch 1 and 2 across species.









Summary, Current conclusions & Ongoing Work

Pig, ferret, then rabbit are the most circular.
    Most distinct in CC and HIP

Mouse, rat, and rabbit are similar in terms of area and perimeter.

There may be less branch complexity in the pig and rat. However, differences in branch 1 and 2 across species need to be considered further.

Current consensus when comparing models:
Mouse, rat, and rabbit can be compared directly without much difference.

Ferret and Pigs may be more circular with minimal branching compared to the other models

Our team and our funding

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Our animals



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