

# Greater variability in rhesus macaque (*Macaca mulatta*) endocranial volume among males

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## 1. Research Questions

- Greater male variability (GMV) is observed in many traits across mammals, including brain size and structure in humans
- Investigating this sex-specific pattern in nonhuman primates may improve our understanding of the evolutionary and developmental mechanisms that underpin GMV in humans

### Questions:

1. Do rhesus macaques display sex differences in brain size variability?
2. What are the potential drivers of sex differences in brain size variability in rhesus macaques?

## 2. Methods

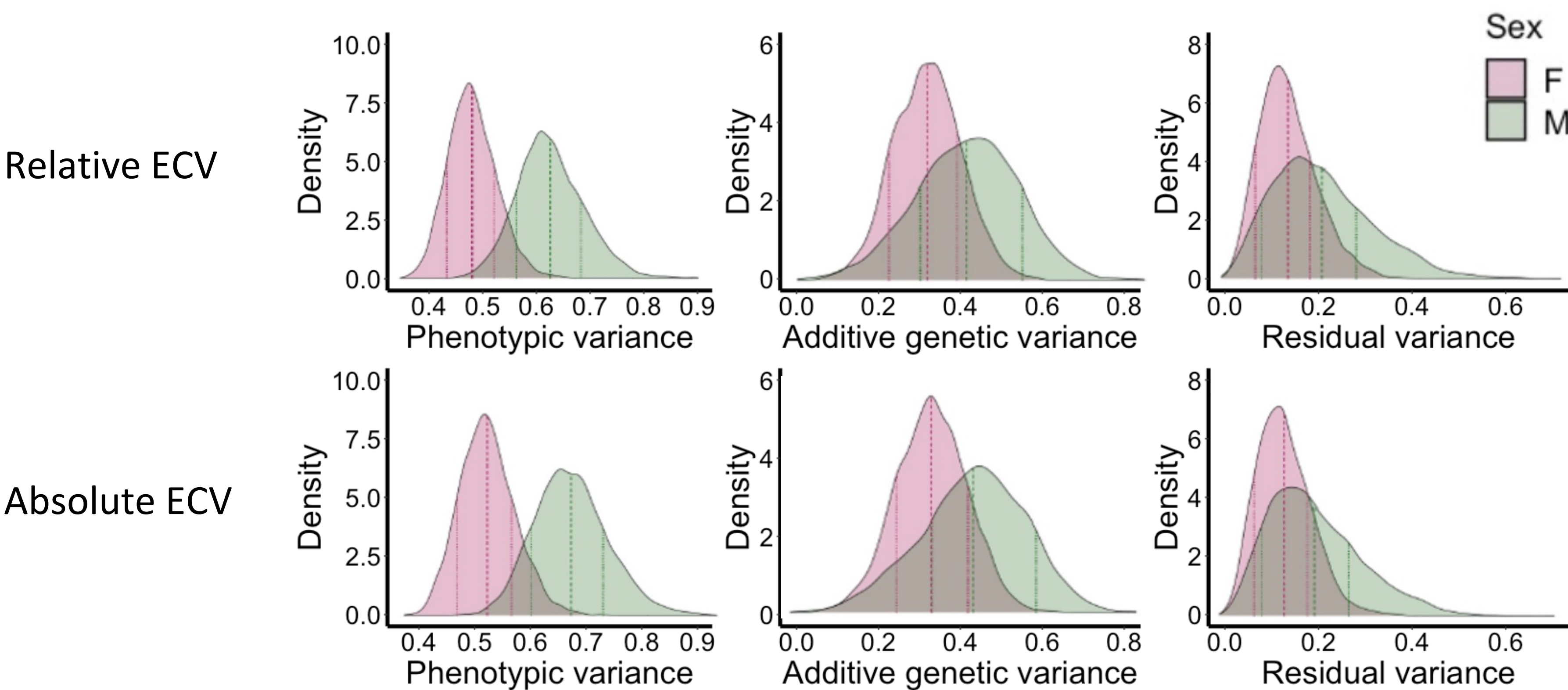
- Measured endocranial volume (ECV) and body size proxies of 542 (300F/242M) pedigreed adult skeletal specimens from Cayo Santiago
- Assessed sex differences in phenotypic variance (**Question 1**), and additive genetic and residual variance (**Question 2**) for relative and absolute ECV using generalized linear mixed models



**Figure 1.** A male (left) and female (right) rhesus macaque on Cayo Santiago. **Photo Credit:** Clare M. Kimock.

## 3. Results

- Males exhibit greater phenotypic variance than females (**Question 1**)
- Males exhibit greater additive genetic variance, but not greater residual variance than females (**Question 2**)



**Figure 2.** Density plots of the posterior distributions of phenotypic, additive genetic, and residual variance for relative and absolute ECV.

**Table 1.** Phenotypic, additive genetic, and residual variance for relative and absolute ECV.

	Phenotypic variance	Additive genetic variance	Residual variance
<b>Relative ECV</b>			
Females	0.503 [0.457,0.540]	0.347 [0.292,0.417]	0.171 [0.109,0.211]
Males	0.646 [0.578,0.693]	0.438 [0.414,0.560]	0.241 [0.119,0.302]
<b>Absolute ECV</b>			
Females	0.533 [0.481,0.568]	0.382 [0.319,0.445]	0.168 [0.112,0.210]
Males	0.670 [0.598,0.717]	0.514 [0.432,0.580]	0.223 [0.115,0.283]

## 4. Conclusions

- GMV in brain size is present in rhesus macaques (**Question 1**)
- GMV in brain size in rhesus macaques is likely driven by some combination of balancing or disruptive selection and sex chromosome effects, not sex differences in developmental schedules (**Question 2**)

### Future Directions

- Future studies should investigate taxa that display a diverse array of mating systems, sex-specific developmental schedules, and sex chromosome compositions to better understand the mechanisms underlying neuroanatomical variability

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