

## COLLEGE OF HEALTH AND BEHAVIORAL SCIENCES FACULTY TEMPLATE



**Full name with degree:** Christine J. Charvet, Ph.D.

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### **Education:**

- **Ph.D.** 2010 Neurobiology and Behavior (University of California, Irvine, CA)
- **B.A.** 2005 Psychology (University of California, Los Angeles, CA)

### **Postdoctoral research experience:**

- 2016-18 Cornell University (Postdoctoral Associate, Statistical Genetics)
- 2015-16 Harvard Medical School and The George Washington University (Postdoctoral Associate, Neuroimaging)
- 2010-14 Cornell University (Postdoctoral Fellow, Psychology)

### **Research Interests:**

- My research focuses on the developmental basis of variation in sensory systems across species. I am especially interested in understanding the developmental basis of neural changes accounting for enhanced visual abilities we see in primates that are not found in other mammals. We focus on

modifications to the timing of developmental processes (e.g., neurogenesis, synaptogenesis, behavioral development) that generate variation in structure and function in the visual system. Understanding how our brains deviate from those of other species is not only intrinsically interesting, it also has applications for the biomedical community. For instance, my collaborators and I developed a website ([translatingtime.net](http://translatingtime.net)), which finds corresponding ages across species (e.g., mouse), including humans. This work is especially important for researchers who use model organisms such as mice to understand basic developmental processes and dysfunctions that occur in humans. Our work enables researchers to translate findings from model organisms to humans.

- If you are a student interested in psychology, anthropology, developmental neuroscience, and/or evolutionary biology and would like to participate in research, please contact me at: [ccharvet@desu.edu](mailto:ccharvet@desu.edu).

### **Recent Presentations by or with Psychology Students at DSU**

- Charvet CJ and Tindal-Burgess DJ. 2019. Extended neurogenesis accounts for the emergence of the primate fovea. Third annual research day. Delaware State University, Dover, DE.
- Charvet CJ and Tindal-Burgess DJ. 2019. Evolving the primate retina: using time to generate high visual acuity. American Association of Physical Anthropology. Cleveland, OH.
- Tindal-Burgess DJ, Finlay BL, Charvet CJ. 2019. Evolving the primate retina: the developmental processes generating variation in retinal structure and function. Annual Neuroscience Symposium. Newark, DE.

### **Approaches to Studying Evolutionary Neuroscience**

- We are focused on integrating multiple methods across scales of organization (from neuroimaging to gene expression to identify developmental sources of variation in brain structure and function across species. We focus especially on the evolution of the visual system.

### **Research Articles**

1. Charvet CJ, Das A, Song JW, Tindal-Burgess DJ\*, Kabaria P, Dai G, Kane T, Takahashi E. 2019. High angular resolution diffusion MRI reveals conserved and deviant programs in the paths that guide human cortical circuitry. *bioRxiv*. 576967. \* Student from DSU.
2. Charvet CJ, Palani A, Kabaria P, Takahashi E. 2019. Evolution of Brain Connections: Integrating Diffusion MR Tractography With Gene Expression Highlights Increased Corticocortical Projections in Primates. *Cerebral Cortex*. In Press.
3. Vasung L, Charvet CJ, Shiohama T, Gagoski B, Levman J, Takahashi E. 2019. Ex vivo fetal brain MRI: Recent advances, challenges, and future directions. *Neuroimage*. 21:195:23-37.
4. Charvet CJ, Finlay BL. 2018. Comparing Adult Hippocampal Neurogenesis Across Species: Translating Time to Predict the Tempo in Humans. *Frontiers in Neuroscience*. 12:706. doi: 10.3389/fnins.2018.00706.
5. Charvet CJ, Šimić G, Kostović I, Kovačević V, Vukšić M, Babić LB, Takahashi E, Sherwood CC, Wolfe MD, Finlay BL. 2017. Coevolution in the timing of GABAergic and pyramidal neuron maturation in primates. *Proceedings of the Royal Society Biological Sciences*. 284:pii: 20171169.
6. Charvet CJ, Hof PR, Raghanti MA, Van Der Kouwe AJ, Sherwood CC, Takahashi E. 2017. Combining diffusion magnetic resonance tractography with stereology highlights increased cross-cortical integration in primates. *Journal of Comparative Neurology*. 525:1075-1093.
7. Charvet CJ, Stimpson CD, Kim YD, Raghanti MA, Lewandowski AH, Hof PR, Gómez-Robles A, Krienen FM, Sherwood CC. 2017. Gradients in cytoarchitectural landscapes of the isocortex:

- Diprotodont marsupials in comparison to eutherian mammals. *Journal of Comparative Neurology*. 525:1811-1826.
8. Charvet CJ, Reep RL, Finlay BL. 2016. Evolution of cytoarchitectural landscapes in the mammalian isocortex: Sirenians (*Trichechus manatus*) in comparison with other mammals. *Journal of Comparative Neurology*. 524:772-82.
  9. Charvet CJ, Cahalane DJ, Finlay BL. 2015. Systematic, cross-cortex variation in neuron numbers in rodents and primates. *Cerebral Cortex*. 25:147-60.
  10. Cahalane DJ, Charvet CJ, Finlay BL. 2014. Modeling local and cross-species neuron number variations in the cerebral cortex as arising from a common mechanism. *Proceedings of the National Academy of Sciences USA*. 111:17642-7.
  11. Charvet CJ, Finlay BL. 2014. Evo-devo and the primate isocortex: the central organizing role of intrinsic gradients of neurogenesis. *Brain Behavior and Evolution*. 84:81-92.
  12. Charvet CJ. 2014. Distinct developmental growth patterns account for the disproportionate expansion of the rostral and caudal isocortex in evolution. *Frontiers in Human Neuroscience*. 8:190.
  13. Finlay BL, Charvet CJ, Bastille I, Cheung DT, Chalfin BP, Muniz JA, Silveira LC. 2014. Scaling the primate lateral geniculate nucleus: Niche and neurodevelopment in the regulation of magnocellular and parvocellular cell number and nucleus volume. *Journal of Comparative Neurology*. 522:1839-57.
  14. Workman AD, Charvet CJ, Clancy B, Darlington RB, Finlay BL. 2013. Modeling transformations of neurodevelopmental sequences across mammalian species. *Journal of Neuroscience*. 33:7368-83. \*\*Recommended by a Faculty of 1000.
  15. Charvet CJ, Darlington RB, Finlay BL. 2013. Variation in human brains may facilitate evolutionary change toward a limited range of phenotypes. *Brain Behavior and Evolution*. 81:74-85. \*\* Commentary in: Vallender EJ. 2013. How brains are built: genetics and evolution. *Brain Behavior and Evolution*. 81:71-3.
  16. McGowan LD, Alaama RA, Freise AC, Huang JC, Charvet CJ, Striedter GF. 2012. Expansion, folding, and abnormal lamination of the chick optic tectum after intraventricular injections of FGF2. *Proceedings of the National Academy of Sciences USA*. 109 Suppl 1:10640-6.
  17. Cahalane DJ, Charvet CJ, Finlay BL. 2012. Systematic, balancing gradients in neuron density and number across the primate isocortex. *Frontiers in Neuroanatomy*. 6:28.
  18. Charvet CJ, Finlay BL. 2012. Embracing covariation in brain evolution: large brains, extended development and flexible primate social systems. *Progress in Brain Research*. 195:71-87.
  19. Charvet CJ, Striedter GF, Finlay BL. 2011. Evo-devo and brain scaling: candidate developmental mechanisms for variation and constancy in vertebrate brain evolution. *Brain Behavior and Evolution*. 78:248-57.
  20. Charvet CJ, Striedter GF. 2011. Developmental modes and developmental mechanisms can channel brain evolution. *Frontiers in Neuroanatomy*. 5:4.
  21. Charvet CJ, Striedter GF. 2011. Causes and consequences of expanded subventricular zones. *European Journal of Neuroscience*. 34:988-93.
  22. Charvet CJ. 2010. A reduced progenitor pool population accounts for the rudimentary appearance of the septum, medial pallium and dorsal pallium in birds. *Brain Behavior and Evolution*. 76:289-300.
  23. Charvet CJ, Striedter GF. 2010. Bigger brains cycle faster before neurogenesis begins: a comparison of brain development between chickens and bobwhite quail. *Proceedings of the Royal Society Biological Sciences*. 277:3469-75.
  24. Charvet CJ, Sandoval AL, Striedter GF. 2010. Phylogenetic origins of early alterations in brain region proportions. *Brain, Behavior and Evolution*. 75:104-10.
  25. Charvet CJ, Striedter GF. 2009. Developmental basis for telencephalon expansion in waterfowl: enlargement prior to neurogenesis. *Proceedings of the Royal Society Biological Sciences*. 276:3421-27.

26. Charvet CJ, Owerkowicz T, Striedter GF. 2009. Phylogeny of the telencephalic subventricular zone in sauropsids: evidence for the sequential evolution of pallial and subpallial subventricular zones. *Brain Behavior and Evolution*. 73:285-294.
27. Charvet CJ, Striedter GF. 2009. Developmental origins of mosaic brain evolution: morphometric analysis of the developing zebra finch brain. *Journal of Comparative Neurology*. 514:203-213.
28. Striedter GF, Charvet CJ. 2009. Telencephalon enlargement by the convergent evolution of expanded subventricular zones. *Biology Letters*. 5:134-137.
29. Charvet CJ, Striedter GF. 2008. Developmental species differences in brain cell cycle rates in the northern bobwhite quail (*Colinus virginianus*) and parakeets (*Melopsittacus undulatus*): implications for mosaic brain evolution. *Brain Behavior and Evolution*. 72:295-306.
30. Charvet CJ, Striedter GF. 2008. Spatiotemporal clustering of cell death in the avian forebrain proliferative zone. *International Journal of Developmental Biology*. 52:345- 352.
31. Striedter GF, Charvet CJ. 2008. Developmental origins of species differences in telencephalon and tectum size: Morphometric comparisons between a parakeet (*Melopsittacus undulatus*) and a quail (*Colinus virginianus*). *Journal of Comparative Neurology*. 507:1663-1675.

### **Book Chapters and Conference Proceedings:**

1. Charvet CJ, Sherwood CC, Takahashi E. 2017. Developmental sequences predict increased connectivity in brain evolution: A comparative analysis of developmental timing, gene expression, neuron numbers, and diffusion MR tractography. In: *Evolution of the Brain, Cognition, and Emotion in Vertebrates*. (eds S. Watanabe, M. Hofman,, T Shimizu). Chapter 4. Brain Science. Springer, Tokyo.
2. Charvet CJ, Krienen FM. 2016. Developmental programs and gene expression patterns yield insights into the evolution of primate cortical circuitry. In: *Evolution of Nervous Systems 2nd edition*. (eds L. Krubitzer and J. Kaas). pp.91-97. Elsevier. Academic Press, Oxford.
3. Charvet CJ, Finlay BL. 2016. Evolving the Developing Cortex. In: *Developmental Approaches to Human Evolution* (eds J. C. Boughner and C. Rolian), John Wiley & Sons, Inc, Hoboken, NJ.
4. Charvet CJ, Cahalane DJ, Finlay BL. 2013. Systematic variation in cytoarchitectural landscapes in the isocortex of primates and rodents. AAI Technical Report FS-13-02.