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## Evan L. MacLean, Ph.D.

Assistant Professor  
Director, Arizona Canine Cognition Center  
School of Anthropology & Department of Psychology  
University of Arizona

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### Contact Information

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### Education

Duke University, Durham, NC  
Ph.D., Evolutionary Anthropology, 2012  
Research Advisor: Brian Hare

Tufts University, Medford, MA  
B.S. (*summa cum laude*) in Psychology, 2004

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### Academic Employment

2017 – Present Assistant Professor, University of Arizona, Department of Psychology (courtesy)  
2016 – Present Assistant Professor, University of Arizona, School of Anthropology (tenure home)  
2016 – Present Adjunct Assistant Professor, Duke University  
2012 – 2016 Senior Research Scientist & Co-Director, Duke Canine Cognition Center, Duke University

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### Journal Articles

\* Signifies mentored student as first author

• Signifies equal contributions

\*Bray, E. E., Levy, K. M., Kennedy, B. S., Duffy, D. L., Serpell, J. A., & **MacLean, E. L.** (Submitted). Predictive models of assistance dog training outcomes using the Canine Behavioral Assessment and Research Questionnaire and a standardized temperament evaluation.

**MacLean, E. L.**, Wilson, S. R., Martin, W. L., Davis, J. M., & Carter, C.S. (Submitted). Measuring Oxytocin: The Blind Men and the Elephant?

•**MacLean, E.L.**, •Snyder-Mackler N., vonHoldt B., & Serpell J (2019). Highly Heritable and Functionally Relevant Breed Differences in Dog Behavior. *bioRxiv*.

\* Horschler, D., Hare, B., Call, J., Kaminski, J., Miklósi, Á., & **MacLean, E. L.** (2019). Absolute brain size predicts dog breed differences in executive function. *Animal Cognition*.

**MacLean, E. L.** & Hare, B. (2018). Enhanced selection of assistance and explosive detection dogs using cognitive measures. *Frontiers in Veterinary Science*.

**MacLean, E. L.**, Gesquiere, L. R., Gee, N., Levy, K., Martin, W. L., & Carter, C. S. (2018). Validation of salivary oxytocin and vasopressin as biomarkers in domestic dogs. *Journal of Neuroscience Methods*, 293(1), 67-76.

Lucca, K., **MacLean, E. L.**, & Hare, B. (2018). The development and flexibility of gaze alternations in bonobos and chimpanzees. *Developmental Science*, e12598.

**MacLean, E. L.**, Gesquiere, L., Gruen, M., Sherman, B., Martin, W. L., & Carter, C. S. (2017). Endogenous oxytocin, vasopressin and aggression in domestic dogs. *Frontiers in Comparative Psychology*, 8,1613.

- MacLean, E. L.**, Gesquiere, L., Gee, N., Levy, K., Martin, W. L., & Carter, C. S. (2017). Effects of human-animal interaction on dog salivary and plasma oxytocin and vasopressin. *Frontiers in Comparative Psychology*, 8, 1606.
- MacLean, E. L.**, Herrmann, E., Suchindran, S., & Hare, B. (2017). Individual differences in cooperative communicative skills are more similar between dogs and humans than chimpanzees. *Animal Behaviour*, 126, 41-51.
- Brandtzaeg, O. K., Johnsen, E., Roberg-Larsen, H., Seip, K. F., **MacLean, E. L.**, Gesquiere, L. R., Leknes, S., Lundanes, E. & Wilson, S. R. (2016). Proteomics tools reveal startlingly high amounts of oxytocin in plasma and serum. *Scientific Reports*, 6, 31693.
- \* Reddy, R. B., Krupenye, C., **MacLean, E. L.**, Hare, B. (2016). No evidence for contagious yawning in lemurs. *Animal Cognition*, 19(5), 889-898.
- MacLean, E. L.** (2016). Unravelling the evolution of uniquely human cognition. *Proceedings of the National Academy of Sciences*, 113(23), 6348-6354
- Stewart, L., **MacLean, E. L.**, Ivy, D., Woods, V., Cohen, E., Rodriguez, K., McIntyre, M., Mukherjee, S., Call, J., Kaminski, J., Miklósi, A., Wrangham, W. & Hare, B. (2015). Citizen science as a new tool in dog cognition research. *PloS one*, 10(9), e0135176.
- MacLean, E. L.**, & Hare, B. (2015). Dogs hijack the human bonding pathway. *Science*, 348(6232), 280-281.
- \* Bray, E. E., **MacLean, E. L.**, & Hare, B. (2015). Increasing arousal enhances inhibitory control in calm but not excitable dogs. *Animal Cognition*, 18(6), 1317-1329
- \*Reddy, R., **MacLean, E. L.**, Sandel, A. A., & Hare, B. (2015). Social and nonsocial inhibitory control in five lemur species. *Primates*, (56), 241-252.
- MacLean, E. L.** & Hare, B. (2015). Bonobos and chimpanzees exploit helpful but not prohibitive gestures. *Behaviour*, 152(3-4), 493-520.
- MacLean, E. L.**, Hare, B., Nunn, C. L., Addessi, E., Amici, F., Anderson, R. C., Aureli, F., Baker, J. M., Bania, A. E., Barnard, A. M., Boogert, N. J., Brannon, E. M., Bray, E. E., Bray, J., Brent, L. J. N., Burkart, J. M., Call, J., Cantlon, J. F., Cheke, L. G., Clayton, N. S., Delgado, M. M., DiVincenti, L. J., Fujita, K., Herrmann, E., Hiramatsu, C., Jacobs, L. F., Jordan, K. E., Laude, J. R., Leimgruber, K. L., Messer, E. J. E., Moura, A. C. de A., Ostojic, L., Picard, A., Platt, M. L., Plotnik, J. M., Range, F., Reader, S. M., Reddy, R. B., Sandel, A. A., Santos, L. R., Schumann, K., Seed, A. M., Sewall, K. B., Shaw, R. C., Slocombe, K. E., Su, Y., Takimoto, A., Tan, J., Tao, R., van Schaik, C. P., Virányi, Z., Visalberghi, E., Wade, J. C., Watanabe, A., Widness, J., Young, J. K., Zentall, T. R., & Zhao, Y. (2014). The evolution of self-control. *Proceedings of the National Academy of Sciences*, 111 (20), E2140-E2148.
- MacLean, E. L.**, Krupenye, C., & Hare, B. (2014). Dogs account for body orientation but not visual barriers when responding to pointing gestures. *Journal of Comparative Psychology*, 128(3), 285-297.
- \* Bray, E., **MacLean, E. L.**, & Hare, B. (2014). Context-specificity of inhibitory control in dogs. *Animal Cognition*. 17(1), 15-31.
- MacLean, E. L.**, Sandel, A. A., Bray, J., Oldenkamp, R., Reddy, R., & Hare, B. (2013). Group size predicts social but not nonsocial cognition in lemurs. *PLOS ONE*, 8(6), e66359.
- MacLean, E. L.** & Hare, B. (2013). Spontaneous triadic engagement in chimpanzees and bonobos. *Journal of Comparative Psychology*. 127(3), 245-255
- MacLean, E. L.**, & Hare, B. (2012). Bonobos and chimpanzees infer the target of another's attention. *Animal Behaviour*, 83(2), 345-353.
- MacLean E. L.**, Matthews L., Hare B., Nunn C., Anderson R., Aureli F., Brannon E., Call J., Drea C., Emery N., Haun D., Herrmann E., Jacobs L., Platt M., Rosati A., Sandel A., Schroeffer K., Seed A., Tan J., van Schaik C., & Wobber V. (2012). How does cognition evolve? Phylogenetic comparative psychology. *Animal Cognition*, 15(2), 1-16.

- MacLean, E. L.**, Mandalaywala, T., & Brannon, E. (2012). Variance-sensitive choice in lemurs: Constancy trumps quantity. *Animal Cognition*, *15*(1), 1-11.
- \*Sandel, A. A., **MacLean, E. L.**, & Hare, B. (2011). Evidence from four lemur species that ringtailed lemur social cognition converges with that of haplorhine primates. *Animal Behaviour*, *81*(5), 925-931.
- Merritt, D., **MacLean, E. L.**, Crawford, J. C., & Brannon, E. M. (2011). Numerical rule-learning in ring-tailed lemurs (*Lemur catta*). *Frontiers in Comparative Psychology*, *2*, 23.
- MacLean, E. L.**, Barrickman, N. L., Johnson, E. M., & Wall, C. (2009). Sociality, ecology, and relative brain size in lemurs. *Journal of Human Evolution*, *56*(5), 471-478.
- MacLean, E. L.**, Prior, S. R., Platt, M. L., & Brannon, E. M. (2009). Primate location preference in a double-tier cage: The effects of illumination and cage height. *Journal of Applied Animal Welfare Science*, *12*(1), 73-81.
- MacLean, E. L.**, Merritt, D. J., & Brannon, E. M. (2008). Social complexity predicts transitive reasoning in prosimian primates. *Animal Behaviour*, *76*(2), 479-486.
- Jordan, K. E., **MacLean, E. L.**, & Brannon, E. M. (2008). Monkeys match and tally quantities across senses. *Cognition*, *108*(3), 617-625.
- Merritt, D. J., **MacLean, E. L.**, Jaffe, S., & Brannon, E. M. (2007). A comparative analysis of serial ordering in ring-tailed lemurs (*Lemur catta*). *Journal of Comparative Psychology*, *121*(4), 363-371.

### Book Chapters and Other Publications

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- MacLean, E. L.** (2018). Comparative methods in the study of animal cognition. In N. Bueno-Guerra & F. Amici (Eds.), *Field and Laboratory Methods in Animal Cognition: A Comparative Guide*, Cambridge University Press. pp. 420-422
- MacNamara, M. & **MacLean, E. L.** (2017). Selecting animals for education environments. In N. Gee, A. Fine, & P. McCardle (Eds.) *How Animals Help Students Learn: Research and Practice for Educators and Mental Health Professionals*. Routledge, Taylor Francis Group. pp. 182-196.
- MacLean, E. L.** & Nunn, C. L. (2017) Phylogenetic approaches for research in comparative cognition. In J. Call, G. Burghardt, I. Pepperberg, C. Snowdon & T. Zentall (Eds.), *APA Handbook of Comparative Psychology*. American Psychological Association. pp 201-215.
- Krupenye, C., **MacLean, E. L.**, & Hare, B. (2016). Does the bonobo have a (chimpanzee-like) theory of mind? *Bonobos: Unique in mind, brain and behavior*. Oxford University Press. pp. 81-94.
- MacLean, E. L.** & Hare, B. (2016). Comparative perspectives on lemur cognition. In E. Palagi & I. Norscia (Eds.), *The Missing Lemur Link: An Ancestral Step in Human Evolution*. Cambridge University Press. pp. 255-529.
- MacLean, E. L.** (Scientific Consultant); Goldish, M. (2013). *Science Dogs* (children's book). Bearport Publishing.

### Awards and Research Grants

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|---------|--|
| 2018-20 | NICHHD – PIs: <b>MacLean &amp; Tecot</b><br>Oxytocin Pathways and the Health Effects of Human-Animal Interaction (\$436,860)                                     |
| 2018-20 | AKC Canine Health Foundation – PIs: Bray & <b>MacLean</b><br>The Effects of Early Life Experience on Working Dog Temperament and Cognition (\$105,949)           |
| 2016-19 | Office of Naval Research – PI: <b>MacLean</b><br>Ontogeny and Heritability of Cognitive and Behavioral Traits Linked to Military Working Dog Success (\$451,920) |
| 2015-17 | Waltham Center for Pet Nutrition – PIs: <b>MacLean</b> , Gesquiere & Carter  |

Salivary Oxytocin and Vasopressin in Domestic Dogs: Methodological Validation and Response to Human-Animal Interaction (\$43,060)

- 2015-16 Stanton Foundation – Next Generation Canine Research Fellowship – PI: **MacLean**  
Roles of Oxytocin and Vasopressin as Neuroendocrine Mediators of Canine Aggression (\$64,833)
- 2014-16 AKC Canine Health Foundation – PIs: **MacLean & Hare**  
Cognitive Predictors of Assistance Dog Success (\$97,809)
- 2011 Duke University, Evolutionary Anthropology Graduate Mentoring Award
- 2009 Duke University, Evolutionary Anthropology Graduate Mentoring Award
- 2009 Duke University, Pre-dissertation travel award
- 2008 Duke University, Evolutionary Anthropology Graduate Mentoring Award
- 2008 Sigma Xi, Sally-Hughes Schrader Travel Grant
- 2007 James B. Duke Fellowship, Duke University
- 2005 Animal Welfare Enhancement Award, Johns Hopkins Bloomberg School of Public Health

### **Consulting Editor**

Journal of Comparative Psychology, 2019 -

### **Ad hoc Reviewer**

American Journal of Primatology | Animal Behaviour | Animal Behavior and Cognition | Animal Cognition | Applied Animal Behaviour Science | Behavioral Sciences | Biology Letters | Cognitive Science | Current Biology | Developmental Science | Endocrine | Ethology | Evolutionary Anthropology | Folia Primatologica | Frontiers in Zoology | Frontiers in Comparative Psychology | Frontiers in Neuroscience | Frontiers in Veterinary Science | General and Comparative Endocrinology | Integrative & Comparative Biology | Journal of the American Academy of Child & Adolescent Psychiatry | Journal of Comparative Psychology | Journal of Zoology | Neuroscience & Biobehavioral Reviews | Physiology & Behavior | PLoS One | Psychoneuroendocrinology | Psychonomic Bulletin and Review | Proceedings of the Royal Society B: Biological Sciences | Proceedings of the National Academy of Sciences (PNAS) | Royal Society Open Science | Scientific Reports

### **Grant Reviewer**

AKC Canine Health Foundation | Austrian Academy of Sciences | European Research Council | German Research Foundation | Guide Dogs Research Committee | National Geographic Society

### **Popular Media Coverage (Selected Examples)**

NY Times | Washington Post | TIME | CBS Sunday Morning | NPR | BBC | National Geographic | Scientific American |

### **Courses Taught**

Animal Minds  
Dog Thought  
Human Cognitive Evolution  
R Programming for Data Analysis and Visualization

### **Academic Service**

2018 - Outreach Committee, School of Anthropology, University of Arizona  
2017 - Computational Social Science Advisory Committee, University of Arizona  
2017 - Graduate Fellowships Committee, School of Anthropology, University of Arizona  
2016-17 Admissions Committee, School of Anthropology, University of Arizona  
2011-2012 Duke University, Evolutionary Anthropology tenure track faculty search committee  
2008-2009 Evolutionary Anthropology Talk Series Coordinator

## Science Outreach

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2018-	Upward Bound (low income high school students on track to be 1 <sup>st</sup> generation college students)
2015	Women in Science and Engineering (WISE) Graduate Student Panel
2014	Rx For Science Literacy: The What, Where, How and Why of Health Science Research, 2014
2012	Kid Science Challenge – “Animal Smarts”

## Graduate Student and Postdoctoral Mentoring

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Emily Bray – University of Arizona (postdoctoral mentor)  
 Gitanjali Gnanadesikan – University of Arizona (PhD student, primary mentor)  
 Daniel Horschler – University of Arizona (PhD student, primary mentor)  
 Kerri Rodriguez – Purdue University (dissertation committee member)

## Undergraduate Student Mentoring

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2017-2018	Mentor, senior thesis – Tegan Wambold
2017-2018	Mentor, independent study – Thomas Kile
2017	Mentor, directed research – Julia Kemper
2014	Mentor, senior thesis – Jeremy Clift
2013	Mentor, senior theses – Emma Blumstein & Leah Kaiser
2012	Mentor, senior theses – Emily Bray & Rachna Reddy
2011	Mentor, Vertical Integration Program – Emily Bray
2011	Mentor, Mechanisms of Behavior Program – Ricki Oldenkamp
2010	Mentor, senior thesis – Aaron Sandel
2009	Mentor, Howard Hughes Summer Scholars Program – Rachna Reddy
2008	Mentor, senior thesis – Jeremy Crawford
2007	Mentor, Vertical Integration Program - Tara Mandalaywala
2007	Mentor, Howard Hughes Summer Scholars Program – Kara Leimberger

## Invited Talks

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Veterinary Meeting & Expo, Orlando, FL 2019  
 Arizona Senior Academy, 2018  
 Yale Alumni Association, 2018  
 Spirit of the Senses, 2018  
 American Association for Laboratory Animal Science, 2018  
 University of Washington, 2018  
 Texas A&M, 2018  
 Canine Science Symposium, San Francisco SPCA, 2018  
 State University of New York, Oneonta - 2017  
 American College of Laboratory Medicine – Forum for Life - 2017  
 Arizona State University – Social Complexity Colloquium – 2017  
 University of Arizona, Cognitive Science Colloquium – 2017  
 Duke Lemur Center 50<sup>th</sup> Anniversary Symposium – 2016  
 Canine Ethology and Behavior Lecture Series – 2016  
 Irish Water Spaniel Club of America – National Specialty, 2016  
 Canine Companions for Independence, 2015  
 University of California, San Diego, 2015  
 University of Arizona, 2015  
 University of Washington, 2014  
 Pilot International, 2014  
 University of Washington, 2014  
 Canine Companions for Independence, 2014  
 Florida Gulf Coast University/Humane Society University, 2014  
 University of Michigan, Ann Arbor, 2014  
 Canine Companions for Independence, 2013  
 Pacific Northwest Police Detection Dog Association, 2013  
 University of Pennsylvania, 2013  
 Penn Vet Working Dogs Conference, 2013  
 North Carolina Cognition Conference, 2013  
 North Carolina State University, 2013

Purina One, 2012  
 Assistance Dogs International, Barcelona, Spain, 2012  
 Hunter College, Exploring Animal Minds, 2012  
 Imperial College London, Canine Science and Technology Forum, 2012  
 Canine Companions for Independence, 2011  
 National Evolutionary Synthesis Center, 2011  
 The University of North Carolina at Chapel Hill, 2011  
 Kyoto University, Japan, 2011  
 Harvard University, 2010  
 National Evolutionary Synthesis Center, 2009

### Presentations and Abstracts

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- MacLean, E. L.** & Horschler, D. J. (2018). Breed Differences in Dog Cognition are Predicted by Absolute Brain Volume. Paper presented at the 126<sup>th</sup> Annual Convention of the American Psychological Association, San Francisco, CA.
- Koopman, S. E., Cantlon J.C., Piantadosi, S.T. & **MacLean, E. L.** (2017). The evolution of quantitative sensitivity. Poster presented at 20<sup>th</sup> SAGA symposium, Aichi, Japan.
- Horschler, D. J., & **MacLean, E. L.** (2017). Absolute Brain Weight Predicts Dog Breed Differences in Working Memory and Social Cognition. Poster presented at the 1<sup>st</sup> North American Canine Science Conference, Tempe, AZ.
- MacLean, E. L.**, Synder-Mackler, N. & Serpell, J.A. (2017). Breed differences in dog behavior are highly heritable. Paper presented at the 1<sup>st</sup> North American Canine Science Conference, Tempe, AZ.
- Serpell, J.A. & **MacLean, E. L.** (2016). Breed Differences in Canine Behavior Covary with Genetic Relationships between Breeds. Paper presented at the 5<sup>th</sup> Canine Science Forum, Padova, Italy.
- Lucca, K., **MacLean, E. L.**, & Hare, B. (2015). The development of multimodal communication in bonobos and chimpanzees. Poster presented at the 2015 Animal Behavior Society Conference. Anchorage, AK.
- Reddy, R. B., Krupenye, C., **MacLean, E. L.**, & Hare, B. (2015). Lemurs Do Not Yawn Contagiously. American Association of Physical Anthropologists 84<sup>th</sup> annual meeting, St. Louis, Missouri.
- MacLean, E. L.** & Hare, B. (2014). Individual Differences in Canine Cognition and Performance as an IED Detection Dog. Canine Science and Technology Workshop, Raleigh, North Carolina.
- MacLean, E. L.**, Hare, B., Nunn, C. L. (2014). Absolute Brain Volume And Dietary Breadth Predict Species Differences In Self-Control. Paper presented at Evolution 2014, Raleigh, North Carolina.
- MacLean, E. L.** & Hare, B. (2014). Convergent Cognitive Structure between Humans and Domestic Dogs. Paper presented at the 4<sup>th</sup> Canine Science Forum, Lincoln, United Kingdom.
- MacLean, E. L.**, Reinhardt, A. L., Suchindran, S., & Hare, B. (2013). Individual Differences in Canine Cognition. Paper presented at the Psychonomic Society Annual Meeting, Toronto, Canada.
- MacLean, E. L.** (2013). Cognitive Predictors of Success as a Working Dog. Eighth International Working Dog Conference, San Antonio, Texas.
- MacLean, E. L.**, & Hare, B. (2013). Cognitive Traits of Successful Assistance Dogs. Paper presented at the 13<sup>th</sup> Triennial Conference of the International Association of Human-Animal Interaction Organizations. Chicago, Illinois.
- MacLean, E. L.**, Sandel, A. A., Bray, J., Oldenkamp, R., Reddy, R., & Hare, B. (2013). Group Size Predicts Social but not nonsocial Cognition in Lemurs. Paper presented at the 20<sup>th</sup> International Conference on Comparative Cognition. Melbourne, Florida.
- Bray, E.E., **MacLean, E.L.**, & Hare, B.A. (2012). Factors Affecting Inhibitory Control in Dogs. Poster presented at 49<sup>th</sup> Annual Meeting of the Animal Behavior Society, Albuquerque, New Mexico.

- MacLean, E.L.**, Rainey, C., Bray, E., Duffy, K., Hare, B. (2012). Cognitive & Temperamental Traits of Successful Assistance Dogs. 21<sup>st</sup> Annual Conference of the International Society of Anthrozoology, Cambridge, United Kingdom.
- Mandalaywala, T.M., **MacLean, E.L.**, & Brannon, E.M. (2011). Risk Aversion in Lemurs. Animal Behavior Society Conference, Bloomington, Indiana.
- MacLean, E.L.**, & Hare, B. A. (2011). Social Motivation For Shared Activities in Chimpanzees and Bonobos. Poster presented at the biennial meeting of the Society for Research in Child Development, Montreal, CA.
- MacLean, E. L.** & Hare, B. A. (2010). Chimpanzees and Bonobos Infer the Rational Target of a Human's Attention. Poster presented at the International Conference on Infant Studies, Baltimore, MD.
- Sandel, A., **MacLean, E. L.**, & Hare, B. (2009). Inhibitory control in an object retrieval task in five lemur species, [Abstract]. *American Journal of Primatology*, 71: S80.
- Brannon, E. M, Merritt, D. J. & **MacLean, E. L.** (2008). A comparative approach to studying quantitative cognition in prosimians. XXII Congress of the International Primatological Society, Edinburgh Scotland, August 3<sup>rd</sup>-8<sup>th</sup>, 2008.
- MacLean, E. L.**, Merritt, D. J. & Brannon, E. M. (2007). Learning to learn and transitivity in prosimians. Poster presented at the biennial meeting of the Society for Research in Child Development, Boston, MA.
- MacLean, E. L.**, Merritt, D. J., & Brannon, E. M. (2007). Transitive inference in two species of prosimian primates [Abstract]. *American Journal of Primatology*, 69(S1), 102.
- Merritt, D. J., **MacLean, E. L.**, & Brannon, E. M. (2007). Serial order processing in ring-tailed lemurs (*Lemur catta*) [Abstract]. *American Journal of Primatology*, 69(S1), 101.
- MacLean, E. L.** & Prior, S. R. (2006). Parsing the variables of illumination and cage height. Paper presented at the PRIM&R (Public Responsibility in Medicine and Research) annual IRB conference, Boston, MA.
- Brannon, E.M., Cantlon, J.F., Cordes, S., Jordan, K.E., Libertus, M., **MacLean, E. L.**, & Suanda, U. (2006). Comparative and developmental approaches to studying nonverbal numerical cognition. Paper presented at the annual meeting of the Psychonomic Society, Houston, TX.
- Jordan, K.E., **MacLean, E. L.**, & Brannon, E.M. (2006). Monkeys match sequentially presented sets with simultaneously presented arrays based on numerosity. Poster presented at the annual meeting of the Vision Sciences Society, Sarasota, FL.