

## Philip L. Reno

## Curriculum Vitae

January 2020

**Address:** Department of Bio-Medical Sciences  
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**Current Position:** Associate Professor of Anatomy

### Education:

2006 Ph.D. Biomedical Sciences, Biological Anthropology, Kent State University, Kent, Ohio  
1997 MA Anthropology, Kent State University, Kent, Ohio  
1994 AB Anthropology, Washington University, St. Louis, Missouri

### Research Interests:

Hominid, primate and vertebrate evolutionary-developmental biology; evolution of primary and secondary sexual characters; skeletal biology; the developmental basis for morphological variation.

### Research Grants:

Current NSF: "Mechanisms of growth plate patterning revealed by natural variation in mammalian ossification." Philip Reno PI, IOS-1656315, \$800,000, 2017-2021.

Current NSF: "Evolution and development of the hominoid wrist." Philip Reno PI, Douglas Menke Co-PI. BCS-1638812, \$233,599, 2017-2020.

2017 NSF: "Doctoral Dissertation Research: Evolution and development of the hominoid thoracolumbar transition." Philip Reno PI, Allison Machnicki Co-PI, BCS-1650879 (\$11,820)

2016 Wenner-Gren Foundation Dissertation Fieldwork Grant: "Evolution and Development of the Hominoid Thoracolumbar Transition." Allison Machnicki Ph.D Student, Philip Reno supervisor. (\$20,000)

2016 Center for Human Evolution and Diversity, Pennsylvania State University Seed Grant: "Evolution and development of the hominoid wrist." Philip Reno PI, Aimin Liu Co-PI, Istvan Albert Co-PI, Leah Bug Co-PI. (\$20,000)

2016 Center for Human Evolution and Diversity, Pennsylvania State University Seed Grant: "Exercise-induces developmental plasticity of musculoskeletal form and function." Jonas Rubenson PI, Stephen Piazza Co-PI, Rudolf Schilder Co-PI, Timothy Ryan Co-PI, Philip Reno Co-PI. (\$20,000)

2016 Huck Institutes of the Life Sciences Exploratory Award: "Transgenic Assay for Androgen Receptor Enhancer Function." Philip Reno, PI. (\$2,942)

2015 NSF: "Doctoral Dissertation Research: Evolutionary and developmental influences on skeletal maturation and internal structure. Philip Reno PI, Kelsey Kjosness Co-PI. BCS-1540418 (\$30,140)

2009 NIH Ruth L. Kirschstein NRSA Post Doctoral Fellowship: "Regulatory architecture of the Androgen Receptor locus in development & evolution."

- 2003 NSF: "Dissertation Improvement: Elucidation of growth plate dynamics via immunohistochemistry of the mammalian metacarpal." BCS-0311768 (\$9132)
- 1997 Sigma XI Grant-in-Aid of Research: "Anthropoid Radial Neck Length and its Implications for Hominid Locomotion" (\$600).

### Professional Experience:

- 2017- Associate Professor, Bio-Medical Sciences, Philadelphia College of Osteopathic Medicine
- 2011-2017 Assistant Professor, Department of Anthropology, Pennsylvania State University
- 2012-2017 Graduate Faculty, Molecular, Cellular and Integrative Biosciences Program, Pennsylvania State University
- 2009-2010 Postdoctoral Fellow, Department of Developmental Biology, Stanford University
- 2007-2009 Research Associate, Howard Hughes Medical Institute and Department of Developmental Biology, Stanford University
- 2006 Research Associate, Department of Anatomy, Northeastern Ohio Universities College of Medicine
- 1998-2005 Teaching Assistant, Northeastern Ohio Universities College of Medicine
- 1998-2001 Instructor, Kent State University.
- 1995-97 Graduate Assistant, Kent State University.

### Publications:

#### Articles

- 2020 Machnicki AL, **Reno PL**. Great apes and humans evolved from a long-back ancestor. *Journal of Human Evolution*. 144:102791(doi.org/10.1016/j.jhevol.2020.102791)
- 2019 Kjosness KJ, **Reno PL**. Identifying the homology of the short human pisiform and its lost ossification center. *EvoDevo* 10:32. DOI: 10.1186/s13227-019-0145-2
- 2017 **Reno PL**. Missing Links *Scientific American*. 316(May 1):42-47.
- 2016 **Reno PL**, Kjosness KM, Hines JE. The role of *Hox* in pisiform and calcaneus growth plate formation and the nature of the zeugopod/autopod boundary. *Journal of Experimental Zoology B (Mol Dev Evol)*. 326B:303-321.
- 2016 Machnicki AL, Lovejoy CO, **Reno PL**. Developmental biology versus typology: Lucy has only four vertebral segments. *American Journal of Physical Anthropology*. 160:729-39.
- 2016 Machnicki AL, Spurlock LB, Strier KB, **Reno PL**, Lovejoy CO. First steps of bipedality in hominids: evidence from the atelid and procunsulid pelvis. *PeerJ* 4:e1521. DOI: 10.7717/peerj.1521.
- 2015 **Reno PL**, Lovejoy CO. From Lucy to Kadanuumuu: Balanced analyses of *Australopithecus afarensis* assemblages confirm only moderate skeletal dimorphism. *PeerJ* 3:e925. DOI 10.7717/peerj.925

- 2014 **Reno PL**. Genetic and developmental basis for parallel evolution and its significance for hominoid evolution. *Evolutionary Anthropology*. 23:188-200.
- 2014 Kjosness KM, Hines JE, Lovejoy CO, **Reno PL**. The pisiform growth plate is lost in humans and supports a role for Hox in growth plate formation. *Journal of Anatomy*. 225:527-38.
- 2013 **Reno PL**, McLean CY, Hines JE, Capellini TD, Bejerano G, Kingsley DM. A penile spine/vibrissa enhancer sequence is missing in modern and extinct humans, but is retained in multiple primates with penile spines and sensory vibrissae. *PLoS ONE*. 8(12): e84258. doi:10.1371/journal.pone.0084258
- 2013 **Reno PL**, Horton WE, Lovejoy CO. Metapodial or phalanx? An evolutionary and developmental perspective on the homology of the first ray's proximal segment. *Journal of Experimental Zoology Part B*. 320B:276-85.
- 2011 McLean CY\*, **Reno PL\***, Pollen AA\*, Bassan AI, Capellini TD, Guenther C, Indjeian VB, Lim X, Menke DB, Schaar BT, Wenger AM, Bejerano G, Kingsley DM. Human-specific loss of regulatory DNA and the evolution of human-specific traits. *Nature*. 471:216-19.  
\* Equal author contribution
- 2010 **Reno PL**, McCollum MA, Meindl RS, Lovejoy CO. An enlarged postcranial sample confirms *Australopithecus afarensis* dimorphism was similar to modern humans. *Philosophical Transactions B*. 365: 3355-63.
- 2008 **Reno PL**, McCollum MA, Cohn MJ, Meindl RS, Hamrick M, Lovejoy CO. Patterns of correlation and covariation of anthropoid distal forelimb segments correspond to *Hoxd* expression territories. *Journal of Experimental Zoology Part B*. 310B:240-58.
- 2007 **Reno PL**, Horton WE, Elsey RM, Lovejoy CO. Growth plate formation and development in alligator and mouse metapodials: evolutionary and functional implications. *Journal of Experimental Zoology Part B*. 308B:283-296.
- 2007 Serrat MA, **Reno PL**, McCollum MA, Meindl RS, Lovejoy CO. Variation in mammalian proximal femoral development: comparative analysis of two distinct ossification patterns. *Journal of Anatomy*. 210:249-258.
- 2006 **Reno PL**, McBurney DL, Lovejoy CO, Horton WE Jr. Ossification of the mouse metatarsal: differentiation and proliferation in the presence/absence of a defined growth plate. *The Anatomical Record*, 288A:104-118.
- 2005 **Reno PL**, DeGusta D, Serrat MA, Meindl RS, White TD, Eckhardt RB, Kuperavage AJ, Galik K, Lovejoy CO. Plio-Pleistocene hominid limb proportions: Evolutionary reversals or estimation errors? *Current Anthropology*, 46:575-588.
- 2005 **Reno PL**, McCollum MA, Meindl RS, Lovejoy CO. The case is unchanged and remains robust: *Australopithecus afarensis* exhibits only moderate skeletal dimorphism. *Journal of Human Evolution*, 49:279-288.
- 2003 **Reno PL**, Meindl RS, McCollum, Lovejoy CO. Sexual dimorphism of *Australopithecus afarensis* was similar to that of modern humans. *Proceedings of the National Academy of Sciences*, 100:9404-9409.

- 2003 Lovejoy CO, McCollum MA, **Reno PL**, Rosenman BA. Developmental biology and human evolution. *Annual Review of Anthropology*, 32:85-109.
- 2000 **Reno PL**, McCollum MA, Lovejoy CO, Meindl RS. Adaptationism and the anthropoid postcranium: Selection does not govern the length of the radial neck. *Journal of Morphology*, 248:59-67.
- 1998 Arfken CL, **Reno PL**, Santiago JV, Klein R. Development of proliferative diabetic retinopathy in African-Americans and whites with Type 1 diabetes. *Diabetes Care*, 21:792-795.
- 1997 **Reno PL**, Arfken CL, Hiens JM, Fisher EB. Factors influencing decision to receive treatment for proliferative diabetic retinopathy. *Diabetes Educator*, 23:653-655.
- 1995 Arfken CL, **Reno PL**. Epidemiology of racial differences in the rates of development and progression of retinopathy. *Diabetes Spectrum*, 8:175-182.

#### Book Chapters

- 2017 Kjosness KM, **Reno PL**. Using comparisons between species and anatomical locations to discover mechanisms of growth plate patterning and differential growth. In C Percival and JT Richtsmeier (Eds.), *Building Bones: Bone Formation in Development and Anthropology*. Cambridge University Press.
- 2016 **Reno PL**. Evo-devo sheds light on mechanisms of human evolution. In J.C. Boughner and C. Rolian (Eds.), *Developmental Approaches to Human Evolution*. Hoboken, NJ: John Wiley & Sons, Inc, pp. 77-99.
- 2015 Puts DA, Bailey DH, **Reno PL**. Contest competition in men. In DM Buss (Ed.), *The Handbook of Evolutionary Psychology*. New York:Wiley & Sons, pp. 385-402.

#### Book Reviews

- 2020 "Across the Bridge: Understanding the Origin of the Vertebrates." Henry Gee. *Quarterly Reviews of Biology*. 95:134-135.
- 2006 "From Biped to Strider: The Emergence of Modern Human Walking, Running, and Resource Transport." D. Jeffrey Meldrum and Charles E. Hilton, eds. *Human Ecology*, 34:731-734.

#### Abstracts

- 2020 Reno PL, Roberts C, Schuetz EK, Kjosness KM, Menke DM. Using normal variation in mouse ossification to identify genes underlying growth plate formation. 171(S69):232. – *Invited symposium, meeting canceled due to Covid-19*
- 2019 Schuetz EK, **Reno PL**. Sex differences in Androgen Receptor enhancer activity and expression during *Mus musculus* embryonic development. *FASEB Journal*. 33:774.29.
- 2019 **Reno PL**. Evolutionary perspectives on human toe reduction. *American Journal of Physical Anthropology* 168(S68):202. – *Invited symposium*.

- 2019 Kjosness KM, **Reno PL**. Assessing the influence of Hox11 genes on calcaneal trabecular bone formation. *American Journal of Physical Anthropology* 168(S68):150.
- 2019 Machnicki AL, **Reno PL**. Great apes and humans evolved from a long-back ancestor. *American Journal of Physical Anthropology* 168(S68):127.
- 2018 **Reno PL**. Sexual dimorphism in an expanding *Au. afarensis* assemblage. *American Journal of Physical Anthropology* 165(S66):224. – *Invited symposium*.
- 2018 Kjosness KM, **Reno PL**. The homology of the human pisiform revealed by comparative ossification timing in hominoids. *American Journal of Physical Anthropology* 165(S66):140.
- 2018 Gavazzi LM, Kjosness KM, **Reno PL**. Xenarthran pisiform morphology and its relation to hominoid locomotor diversity. *American Journal of Physical Anthropology* 165(S66):96.
- 2017 Machnicki AL, Hrycaj SM, Wellik DM, **Reno PL**. Spinal process shape and vertebral immobility in hominoids and Hox9 mutant mice. *FASEB Journal*. 578.17
- 2016 **Reno PL**, Kjosness KM, Hines JE. The role of *Hox* in pisiform and calcaneus ossification and the nature of the zeugopod/autopod boundary. *International Congress of Vertebrate Morphology*.
- 2016 Kjosness KM, **Reno PL**, Hines JE. Hoxa11 and Hoxd11 loss-of-function mutations alter pisiform growth plate organization. *International Congress of Vertebrate Morphology*.
- 2016 Machnicki AL, **Reno PL**. Evolution of spinous process shape and vertebral immobility in hominoids. *International Congress of Vertebrate Morphology*.
- 2016 **Reno PL** and Kjosness KM. The hominid wrist and the role of developmental perspectives on inferring homoplasy. *American Journal of Physical Anthropology*. 159:267- *Invited symposium*
- 2016 Kjosness KM, Hines JE, **Reno PL**. Hoxa11 and Hoxd11 influence pisiform length through altered growth plate organization. 159:192 *American Journal of Physical Anthropology*. 159:
- 2016 Machnicki AL, Spurlock LB, Strier KB, **Reno PL**, Lovejoy CO. First steps of bipedality in hominids: evidence from the pelvis of *Proconsul* and atelids. *American Journal of Physical Anthropology*. 159:
- 2015 Kjosness KM, Hines JE, **Reno PL**. Hoxd11 influences growth plate organization in the mammalian pisiform. *FASEB J*. 29. – Finalist for student presentation at American Association of Anatomists.
- 2014 **Reno PL**. Evo-devo sheds light on mechanisms of human evolution and parallelism in hominoids. *American Journal of Physical Anthropology*. 153(S54):220. - *Invited symposium*

- 2014 Kjosness KM, Hines JE, Lovejoy CO, **Reno PL**. Making a 'short bone' short: Human pisiform reduction results from the loss of a growth plate. *American Journal of Physical Anthropology*. 153(S54):158-159. - *Invited symposium*
- 2013 Kjosness KM, Hines JE, Lovejoy CO, **Reno PL**. The pea-shaped pisiform results from the evolutionary loss of a growth plate. *FASEB J*. 27:520.7.
- 2011 **Reno PL**, McLean CY, Pollen AP, Bejerano G, Kingsley DM. Human-specific loss of an androgen receptor enhancer is associated with the loss of vibrissae and penile spines. *American Journal of Physical Anthropology*, Supplement 52:252.
- 2007 **Reno PL**, Lovejoy CO. The genetics of post-cranial skeletal development: Implications for interpreting primate morphological variation. *American Journal of Physical Anthropology*, Supplement 44:197-198. - *Invited symposium*
- 2006 Reno PL, Lovejoy CO, Elsey RM, Horton WE. Comparative development of mammalian and alligator growth plate formation. *Developmental Biology*, 295:415.
- 2005 **Reno PL**, McBurney DL, Lovejoy CO, Horton WE. Comparative analysis of mouse metatarsal ossification and implications for differential skeletal growth. *Integrative and Comparative Biology*, 45:1061.
- 2005 **Reno PL**, McBurney DL, Lovejoy CO, Horton WE Jr. Comparative analysis of murine metatarsal ossification and implications for differential skeletal growth in primates. *American Journal of Physical Anthropology*, Supplement 40:180.
- 2005 Lovejoy CO, **Reno PL**, Meindl RS. The skeletal dimorphism of *Australopithecus afarensis*. *American Journal of Physical Anthropology*, Supplement 40:145. - *Invited symposium*
- 2004 **Reno PL**, McBurney DL, Lovejoy CO, Horton WE Jr. Comparative analysis of ossification in the presence/absence of a defined growth plate. *Journal of Morphology*, 260:321.
- 2004 **Reno PL**, Meindl RS, McCollum MA, Lovejoy CO. Comparison of "sex blind" dimorphism indices with application to the *A. afarensis* fossil assemblage. *American Journal of Physical Anthropology*. Supplement 38:166.
- 2003 **Reno PL**, Serrat MA, Meindl RS, Cohn MJ, Lovejoy CO. Hominoids, Hindlimbs and Hox: Implications for hominid evolution. *American Journal of Physical Anthropology*, Supplement 36:189.
- 2003 Serrat MA, **Reno PL**, Rosenman BA, Lovejoy CO. Developmental Field Fluctuation II: A potential basis for skeletal morphological variation. *American Journal of Physical Anthropology*, Supplement 36:177-78.
- 2002 **Reno PL**, Kriz MA, McCollum MA, Lovejoy CO, Horton WE Jr. Scanning electron microscopic analysis of regional histomorphological variation within the physis of the primate proximal femur. *American Journal of Physical Anthropology*, Supplement 34:130.

- 2002 Kriz MA, **Reno PL**, Lovejoy CO. Morphometric variation in proximal femoral development in primates and mammals. *American Journal of Physical Anthropology*, Supplement 34:97-98.
- 2002 Lovejoy CO, **Reno PL**, Kriz MA, Rosenman, BA. Developmental Field Fluctuation: a potential basis for skeletal morphological variation. *American Journal of Physical Anthropology*, Supplement 34:104.
- 2001 **Reno PL**, Lovejoy CO, McCollum MA, Hamrick MW, Meindl RS, Cohn MJ. Ontogenetic data suggest the presence of HOXD targets that act as growth scalars in the hominoid forelimb. *American Journal of Physical Anthropology*, Supplement 32:125.
- 2000 Lovejoy CO, **Reno PL**, McCollum MA, Hamrick MW, Cohn MJ. Evolution of primate hands: Growth scaling registers with posterior HOXD expression. *American Zoologist* 40:1109.
- 2000 Lovejoy CO, **Reno PL**, McCollum MA, Hamrick MW, Cohn MJ. Evolution of hominoid hands: Growth scaling registers with posterior HOXD expression. *American Journal of Physical Anthropology*, Supplement 30:214.
- 1999 **Reno PL**, Lovejoy CO, Kern KF, Simpson SW, Meindl RS. Estimation of sexual dimorphism in fossil species including *Australopithecus afarensis*: A new technique and tests of its accuracy using extant hominoids. *American Journal of Physical Anthropology*, Supplement 28:231.
- 1998 **Reno PL**, Lovejoy CO, Meindl RS, McCollum MA. An integrative approach to hominoid forelimb elongation. *American Journal of Physical Anthropology*, Supplement 26:187.
- 1997 **Reno PL**, McCollum MA, Lovejoy CO. Anthropoid radial neck length and its implications for hominid locomotion. *American Journal of Physical Anthropology*, Supplement 24:197.

#### Posters

- 2012 **Reno PL**, McLean CY, Pollen AP, Bejerano G, Kingsley DM. Human-specific loss of an androgen receptor enhancer is associated with the loss of vibrissae and penile spines. *Mid-Atlantic Regional Meeting of the Society for Developmental Biology*. University Park, PA.
- 2003 **Reno PL**, McBurney DL, Lovejoy CO and Horton WE Jr. Ossification patterns in the presence/absence of a defined growth plate. *Midwest Connective Tissue Workshop*. Chicago, IL.

#### Invited Meetings and Workshops:

- 2009 *The First 4 Million Years of Human Evolution*. The Royal Society, London, UK. October 19-20.
- 2005 *The World Summit on Evolution*, Galapagos Academic Institute for the Arts and Sciences, Universidad San Francisco de Quito, Ecuador. June 9-12.

2004 *The Miocene Hominoid Postcranial Evolution Workshop*. Center for the Study of Human Evolution, New York University. May 19-21.

### Invited Lectures

- 2015 “Genomic and phenotypic approaches to human evo-devo: Penile spine loss and pisiform reduction” presented to the Human Evolutionary Biology department, Harvard University.
- 2012 “*Australopithecus afarensis* skeletal dimorphism and early hominid reproductive biology.” Co-presenter and discussant at the Boston University Dialogues Series, “Does Size Matter? Sexual Dimorphism and Human Evolution.”
- 2011 “Human-specific loss of regulatory DNA and the evolution of human-specific traits” presented to Department of Biology, Duquesne University.
- 2010 “Developmental Approaches to Human Evolution: Limb Proportions and Spines” presented as the plenary lecture to Genetic and Evolutionary Skeletal Research Initiative UC-Berkeley.
- 2009 “Developmental Approaches to Human Evolution” Department of Anthropology UC-Santa Cruz.
- 2008 “Evolution of the Human Phenotype” presented to CS273A: A computational tour of the Human Genome, Stanford University.
- 2003 “Limb Development: Initial Outgrowth and Patterning” presented to ANAT 391/491 Human Embryology, Case Western Reserve University Medical School.
- 2002 “Limbs I: Outgrowth & Initial Patterning” presented to ANAT 391/491 Human Embryology, Case Western Reserve University Medical School.
- 2002 “Limbs II: Morphogenesis and Skeletal Development” presented to ANAT 391/491 Human Embryology, Case Western Reserve University Medical School.

### Courses Taught:

Structural Principles of Medicine – DO Medical Gross Anatomy, Lecturer and Lab Instructor, Philadelphia College of Osteopathic Medicine.

Gross Anatomy for Health Sciences (PA and PT students), Lecturer and Lab Instructor, Philadelphia College of Osteopathic Medicine.

Human Anatomy (Masters Students), Lecturer and Lab Instructor, Philadelphia College of Osteopathic Medicine.

ANTH 597: Human Gross Anatomy 1, Instructor and course developer, Pennsylvania State University.

ANTH 403: Evolution of Human Walking, Instructor and course developer, Pennsylvania State University.

ANTH 468: Evolution and Development of Human Origins, Instructor and course developer, Pennsylvania State University.

ANTH 021: Introductory Biological Anthropology, Instructor, Pennsylvania State University



ANTH 470H: Our Place in Nature, Instructor, Pennsylvania State University.

Human Development and Structure, Lecturer and Lab Instructor, Northeastern Ohio Universities  
College of Medicine, Rootstown, OH.

ANTH 38490 Quantitative Anthropology (Statistics), Instructor, Kent State University.

### **Theses Supervised**

#### *Primary Advisor*

Allison Machnicki, 2018, "Developmental approaches to evolution of hominoid back evolution."  
Ph.D. Department of Anthropology, Ph.D. Department of Anthropology, The  
Pennsylvania State University. Recipient of an NSF Graduate Research Fellowship.

Catherine Roberts, 2018. MA, The Pennsylvania State University.

Lia Gavazzi, 2018. MA, The Pennsylvania State University.

Kelsey Kjosness, 2017, *Evolution and developmental mechanisms of pisiform growth plate loss*.  
Ph.D. Department of Anthropology, The Pennsylvania State University.

Jamie Ranalli, 2017, "Development of the calcaneus growth plate in the mouse." BS, Schreyer  
Honors College, The Pennsylvania State University.

Andrew Georgeson, 2013, "Milligan's trichrome stain for use in comparing the development of  
penile spines to hair and nails in mice." BS, Schreyer Honors College, The Pennsylvania  
State University.

#### *Committee Member*

Simone Sukdeo, 2017, Ph.D., Department of Anthropology, Penn State.

Scott Hergenrother, 2015, Ph.D., Duquesne University.

Nergiz Dogan, 2014, Ph.D., Biochemistry, Microbiology, and Molecular Biology, Penn State.

Ben Connor, BS, Schreyer Honors College, The Pennsylvania State University.

### **Professional Affiliations:**

American Association of Anatomists

American Association of Physical Anthropologists

### **References**

Dr. C. Owen Lovejoy  
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