

CURRICULUM VITAE

Name: Christopher B. Ruff, Ph.D.

Address: Center for Functional Anatomy and Evolution
The Johns Hopkins University School of Medicine
1830 E. Monument St., Baltimore, MD 21205
(e-mail: cbruff@jhmi.edu)

Date of Birth: January 15, 1953

Place of Birth: Ramsey, New Jersey

Education:

1975 B.A. Stanford University (anthropology)

1981 Ph.D. University of Pennsylvania (biological anthropology)

Postdoctoral Training:

1981-1983 Research Fellow, Department of Orthopaedic Surgery,
Beth Israel Hospital and Harvard Medical School, Boston, MA

Academic Appointments:

1978-1980 Instructor, Department of Anthropology
Boston University, Boston, MA

1980-1981 Lecturer, Department of Health Sciences, Sargent College
of Allied Health Professions, Boston University,
Boston, MA

1983, 1988, 1994 Assistant, Associate, Full Professor, Department of Cell Biology
and Anatomy (from 2001, Center for Functional Anatomy and
Evolution), and Department of Orthopaedic Surgery,
The Johns Hopkins University School of Medicine,
Baltimore, MD

2001- Director, Center for Functional Anatomy and Evolution, The Johns Hopkins University School of Medicine, Baltimore, MD

Research Appointment:

1986- Guest Researcher, Gerontology Research Center, NIA/NIH, Francis Scott Key Medical Center, Baltimore, MD

Awards and Honors:

1975 Phi Beta Kappa, Stanford University

1975-1978 University Fellowship, University of Pennsylvania

1982-1983 NIH Traineeship, Harvard University Medical School

1982-1983 William F. Milton Fund Fellow, Harvard University

1994-1995 Excellence in Teaching Award, Medical Student Society, The Johns Hopkins University School of Medicine

1999 Paul T. Baker Distinguished Lecturer Award, Pennsylvania State University

2002 Fellow, American Association for the Advancement of Science, Anthropology Section

Major Research Interests:

1. Skeletal biology and biomechanics
2. Primate functional morphology and evolution
3. Osteoporosis
4. Climatic adaptation

Research Grants:

1983-1985 NIH New Investigator Research Award: "Geometrical Remodeling of the Adult Human Femur and Tibia", \$65,476.

- 1984-1986 NSF: "Cross-sectional Geometric, Trace Element and Stable Isotope Analysis of Skeletal Material", \$10,447 (Co-PI; subcontract of research grant to C.S. Larsen).
- 1985-1986 L.S.B. Leakey Foundation: "Biomechanical Analysis of Lower Limb Cross-sectional Geometry in Early Hominids from Lake Turkana and Olduvai Gorge", \$4000. (returned)
- 1986-1988 NSF: "Biomechanical Analysis of Lower Limb Cross-sectional Geometry in Early Hominids from Lake Turkana and Olduvai Gorge", \$41,819.
- 1986-1988 Orthopaedic Research and Education Foundation: "Effects of Long-term Exercise on Bone Loss in Older Dogs", \$69,221.
- 1987-1988 NSF: "Biomechanical Analysis of Femoral and Humeral Cross Sections in the Santa Catalina de Santa Maria Skeletal Sample", \$5,262 (Co-PI; subcontract of research grant to C.S. Larsen).
- 1988-1989 Johns Hopkins University Institutional Research Grant: "Effects of Long-term Exercise on Bone Loss in Older Dogs: In-Vitro Skeletal Analyses", \$10,309.
- 1988-1991 Wenner-Gren Foundation for Anthropological Research: "Structural Analysis of the Hominoid Forelimb Skeleton", \$9,000.
- 1990-1993 NSF: "Cross-sectional and Articular Structure of the Anthropoid Limb Skeleton", \$94,914.
- 1990-1993 NIH: "Effects of Aging and Exercise on Bone Mass in Beagles", \$235,000.
- 1990-1994 NIH: "Structural Analysis of Hip Bone Mineral Image Data", \$468,000 (Co-PI; T.J. Beck, PI).
- 1992 NSF Dissertation Improvement Grant (for J.A. Runestad, Ph.D. candidate): "Structural Properties of Prosimian and Small Anthropoid Limb Bones: Estimation of Body Mass and Locomotor Mode in Fossil Prosimians", \$10,693.
- 1992-1995 U.S. Navy: "Use of Non-invasive Bone Structural Measurements for Stress Fracture Prediction", \$113,008 (Co-PI; T.J. Beck, PI).
- 1994-1995 NSF Dissertation Improvement Grant (for K.L. Rafferty, Ph.D. candidate): "Joint Structure and Function in Extant Primates and Subfossil Lemurs", \$10,690.

- 1995-1997 Defense Women's Health Research Program (U.S. Army): "Structural Indices of Stress Fracture Susceptibility in Female Military Recruits", \$542,494 (Co-PI; T.J. Beck, PI).
- 1996-1997 Johns Hopkins Hospital: "Non-Destructive Skeletal Analysis of Human Remains, Hampstead Hill Site (18BC111)", \$33,839.
- 1996-1998 Wenner-Gren Foundation for Anthropological Research: "Ontogenetic Changes in Limb Bone Structure in the Denver Growth Study Sample", \$6100.
- 1997-2000 NASA: "Skeletal Structural Consequences of Reduced Gravity Environments", \$349,000 (PI).
- 1998-1999 L.S.B. Leakey Foundation : "Long Bone Structural Analysis of South African Early Hominids", \$5668 (PI).
- 1998-2000 NIH: "Structural Analysis of DEXA Scans from Osteoporosis Studies", \$520,000 (Co-PI, T.J. Beck, PI).
- 2001-2004 NASA: "Defining and Preventing Bone Loss: A Microgravity Model" (subcontract), \$86,970 (Co-PI, J. Shapiro, PI).
- 2001-2004 NIH: "Structural Analysis of DEXA Scans from Osteoporosis Studies", \$871,000 (Co-PI, T.J. Beck, PI).
- 2002 NSF Dissertation Improvement Grant (for A.Zumwalt, Ph.D. candidate): "The Effect of Exercise on the Morphology of Muscle Attachment Scars", \$11,977.
- 2005-2006 NSF Dissertation Improvement Grant (for M. O'Neill, Ph.D. candidate): "Energetics and Mechanics of Quadrupedal Walking and Running in Prosimians", \$11,991.
- 2006-2007 NSF Dissertation Improvement Grant (for B. Auerbach, Ph.D. candidate): "Human Skeletal Variation in the Prehistoric New World: Geographic, Temporal, and Climatic Effects", \$11,158.
- 2007-2010 NSF: "On the Verge of Modernity: Post-Pleistocene Evolution of the European Skeleton", \$160,000 (PI).

Memberships, Offices and Committee Assignments:

- 1977- American Association of Physical Anthropologists
- 1982- American Association for the Advancement of Science

1985-2004	Orthopaedic Research Society
1985-1994	State Anatomy Board of Maryland; Chairman 1992-1994
1989-1991	Medical School Council, Johns Hopkins University
1990-1994	Associate Editor, <i>American Journal of Physical Anthropology</i>
1991-1994	Advisory Panel for Physical Anthropology, National Science Foundation
1993	External Review Committee, Department of Anatomical Sciences, State University of New York at Stony Brook
1995-1998	Associate Editor, <i>Journal of Human Evolution</i>
1996-1997	Basic Science Faculty Compensation Committee, Johns Hopkins University School of Medicine
1997-2001	Member-at-Large, Section Committee on Anthropology, American Association for the Advancement of Science
1997-1999	Science and Grants Committee, LSB Leakey Foundation
1998-2002	Editor, <i>Yearbook of Physical Anthropology</i>
1998-2003	Member, Executive Committee and Publications Committee; Chair, Nominating Committee (1999-2000); Chair, American Journal of Physical Anthropology Editor Search Committee (2000-2001); American Association of Physical Anthropologists
1999-	American Society for Bone and Mineral Research
2000-	Editorial Board, <i>Anthropological Science (Journal of the Anthropological Society of Nippon (Japan))</i>
2002-	Sigma Xi
2006	Student Prize Award Committee, American Association of Physical Anthropologists annual meeting
2006	Member, <i>Yearbook of Physical Anthropology</i> Editor Search Committee; American Association of Physical Anthropologists.
2007-2013	Editor, <i>American Journal of Physical Anthropology</i>

Teaching Experience:

- 1978 Department of Anthropology, Rutgers University, Camden, NJ (biological and cultural anthropology)
- 1978-1980 Department of Anthropology, Boston University, Boston, MA (biological anthropology)
- 1979-1981 Department of Anthropology, University of Massachusetts, Boston, MA (biological anthropology and archaeology)
- 1980-1981 Department of Health Sciences, Sargent College of Allied Health Professions, Boston University, Boston, MA. (human gross anatomy)
- 1983- “Human Anatomy” (Course Director, 1993-1995), “Functional Morphology and its Applications”, “Biomechanics”, “Topics in Allometry”, Department of Cell Biology and Anatomy, and Center for Functional Anatomy and Evolution, The Johns Hopkins University School of Medicine, Baltimore, MD
- 1999 “Introduction to Skeletal Biology”, Department of Biology, The Johns Hopkins University, Baltimore, MD
- 2004, 2005 “Introduction to the Human Skeleton”, Department of Biology, The Johns Hopkins University, Baltimore, MD

Field and Other Experience:

- 1973 Denali Range, Alaska: Archaeological Field School (sponsored by Alaska Methodist University), June-July.
- 1985 St. Catherine's Island, Georgia: Excavation of early historic cemetery (with C.S. Larsen), July.
- 1986 Nairobi, Kenya: Work in Kenya National Museums on early hominid and hominoid fossil material, June.
- 1988 Reno, Nevada: CT scanning of Great Basin human archaeological sample (with C.S. Larsen and R.L. Kelly), Nevada State Museum and Veterans Administration Hospital, May.
- 1992 Kampala, Uganda and Nairobi, Kenya: Work at Makerere University Medical School and Kenya National Museums on modern and fossil hominid, hominoid, and cercopithecoid material, July-August.

- 1998 Pretoria and Johannesburg, South Africa: Work at Transvaal Museum and Dept. Anthropology, University of the Witwatersrand, CT scanning of early hominid material, July.
- 1999 Lisbon, Portugal: CT scanning of juvenile Upper Paleolithic skeleton from Lagar Velho, Portugal, July.
- 2005, 2006 Konya, Turkey: Work at early Neolithic site of Çatalhöyük, July.

Student Advising and Thesis Supervision (external advisor or primary internal advisor only):

- 1982-1983 Deborah Stevens: "Skeletal Aging and Exercise in a Hamster Model", B.S. Senior Thesis, Massachusetts Institute of Technology.
- 1982-1983 Jim Prizant: "Cross-sectional Geometry of the Human Tibia: General Morphology, Sex and Age Differences", B.S. Senior Thesis, Massachusetts Institute of Technology.
- 1984-1985 Sharon L. Brock: "Biomechanical Adaptation of the Lower Limb Bones Through Time in the Prehistoric Southwest", Ph.D. Thesis, Dept. Anthropology, University of New Mexico.
- 1986-1988 Thomas Beck: "Non-invasive Estimation of Structural Geometry in the Human Hip from Bone Mineral Data", Sc.D. Thesis, School of Hygiene and Public Health, The Johns Hopkins University.
- 1986-1988 Michael Torchia: "Quantitative Femoral Remodeling Following Hip Arthroplasty", Student Research Internship, awarded the 1988 Paul Ehrlich Medical Student Award, School of Medicine, The Johns Hopkins University.
- 1987-1989 Marvin Ashford: "Mechanical Analysis of the Aging Beagle Skeleton", M.E.B.E. Thesis, School of Medicine, The Johns Hopkins University.
- 1991-1994 Jacqueline Runestad: "Humeral and Femoral Diaphyseal Cross-Sectional Geometry and Articular Dimensions in Prosimii and Platyrrhini (Primates) with Application for Reconstruction of Body Mass and Locomotor Behavior in Adapidae (Primates: Eocene)", Ph.D. Thesis, School of Medicine, The Johns Hopkins University.
- 1992-1994 Steven Churchill: "Human Upper Body Evolution in the Eurasian Later Pleistocene", Ph.D. Thesis, Dept. Anthropology, University of New Mexico.

- 1993-1995 Ronald Heinrich: "Limb Biomechanics in Caniform Carnivora: Relationships of Size, Function, and Phylogeny to Cross-Sectional Geometry in Extant and Fossil Taxa", Ph.D. Thesis, School of Medicine, The Johns Hopkins University.
- 1993-1996 Katherine Rafferty: "Joint Structure and Function in Extant Primates and Subfossil Lemurs", Ph.D. Thesis, School of Medicine, The Johns Hopkins University.
- 1994-1995 Trenton Holliday: "Body Size and Proportions in the Late Pleistocene Western Old World and the Origins of Modern Humans", Ph.D. Thesis, Dept. Anthropology, University of New Mexico.
- 1996-1999 Naoko Egi: "Functional Morphology of the Appendicular Skeleton in Eocene Hyaenodontid Creodonta", Ph.D. Thesis, School of Medicine, The Johns Hopkins University.
- 1999-2002 Yisheng Li: "Postnatal Development of Pelvic Sexual Dimorphism in Four Anthropoid Primates", Ph.D. Thesis, School of Medicine, The Johns Hopkins University.
- 1999-2000 Sachin Rastogi: "Development of Mechanical Countermeasures to Prevent Bone Loss Associated with Microgravity", M.S. Thesis, Dept. Biomedical Engineering, The Johns Hopkins University.
- 1999-2000 Marsha Ogilvie: "The Skeletal Biology of Late Archaic Populations with the Adoption of Agriculture in the American Southwest", Ph.D. Thesis, Dept. Anthropology, University of New Mexico.
- 2000-2001 Elizabeth Weiss: "A Cross-Cultural Study of Humeri: Environmental Causes of Morphology", Ph.D. Thesis, Dept. Anthropology, University of Arkansas.
- 2002-2004 Ann Zumwalt: "The Effect of Exercise on the Morphology of Muscle Attachment Scars", Ph.D. Thesis, School of Medicine, The Johns Hopkins University.
- 2004-2006 Katherine Whitcome: "Obstetric Load and the Evolution of Human Lumbopelvic Sexual Dimorphism", Ph.D. Thesis, University of Texas.
- 2004- Mathew O'Neill: "Energetics and Mechanics of Quadrupedal Walking and Running in Prosimians", Ph.D. Thesis, School of Medicine, The Johns Hopkins University.

2004- Benjamin Auerbach: "Human Skeletal Variation in the Prehistoric New World: Geographic, Temporal and Climatic Effects", Ph.D. Thesis, School of Medicine, The Johns Hopkins University.

Invited Lectures:

- 1980 "Bones and Behavior: The Application of Biomechanics Theory to Biological Anthropological Problems", Department of Anthropology, Boston University, April.
- 1981 "Osteoporosis, Skeletal Remodeling, and Fracture Incidence among the Elderly", Departments of Physical Therapy and Anatomy University of Southern California, July.
- 1983 "Femoral and Tibial Geometries: Use in Prosthesis Design", German Traveling Orthopaedic Fellows, Children's Hospital, Boston, March.
- 1983 "Structural Characterization of the Lower Limb Bones: Clinical Applications in Orthopaedics", Department of Orthopaedic Surgery, Beth Israel Hospital, Boston, February.
- 1983 "Geometrical Characterization of the Human Lower Limb Bones: Anthropological and Orthopaedic Applications", Department of Cell Biology and Anatomy, The Johns Hopkins University Medical School, April .
- 1984 "Reading Behavior from Bones - New Approaches to Structural - Functional Analysis of the Skeleton", Department of Cell Biology and Anatomy, The Johns Hopkins University Medical School, April.
- 1986 "Lower Limb Bone Remodeling in Adulthood: Relationship to Activity and Mechanical Loadings", Department of Orthopedic Surgery, The Johns Hopkins University Medical School, April.
- 1986 "The Relative Thickness of the Long Bones in Primates - Adolf Schultz Revisited", Department of Cell Biology and Anatomy, The Johns Hopkins University Medical School, April.
- 1986 "Biomechanics and the Analysis of Long Bone Structure", Kenya National Museums, Nairobi, Kenya, June.
- 1987 "Sex, Subsistence and Mobility: Evidence from the Lower Limb" Department of Cell Biology and Anatomy, The Johns Hopkins

University Medical School, April.

- 1987 "Biomechanics as a Method of Structural Analysis in Physical Anthropology", in American Anthropological Association Symposium "The Future of Evolutionary Studies in Physical Anthropology: Centennial of the Birth of Earnest A. Hooton (1887-1954)", Jon Marks, Organizer, Chicago, November.
- 1988 "Aging, Exercise, and Skeletal Remodeling in the Beagle Dog", Biogerontology Laboratory, University of Wisconsin Center for Health Sciences, Madison, March.
- 1988 "Sexual Dimorphism in Lower Limb Bones: Behavioral and Economic Implications", Department of Anthropology, University Of Wisconsin, Madison, March.
- 1988 "Beagles, Bones Scans, and Joints", Department of Cell Biology and Anatomy, The Johns Hopkins University Medical School, April.
- 1989 "Hindlimb Bone Structure in Early Hominids and Hominoids", Department of Cell Biology and Anatomy, The Johns Hopkins University Medical School, January.
- 1989 "Cross-Sectional Geometric Properties of the Femoral Midshaft: Mechanical and Behavioral Implications", in Smithsonian Institution Conference "Skeletal Biology in the Great Plains: A Multidisciplinary View", D. Owsley, Organizer, Washington, D.C., March.
- 1989 "New Approaches to Structural Evolution of Limb Bones in Primates", in Kartause Ittingen Symposium "New Quantitative Developments in Primatology and Anthropology", R.D. Martin, Organizer, Kartause Ittingen, Switzerland, September.
- 1990 "Climate, Body Size and Body Shape in Hominid Evolution", Department of Cell Biology and Anatomy, The Johns Hopkins University Medical School, January.
- 1990 "Mechanical Properties of Bone", Department of Biomedical Engineering, The Johns Hopkins University Medical School, February.
- 1990 "Exercise and Osteoporosis", Annual Meeting of the Inter-urban Orthopaedic Society, The Johns Hopkins University Medical School, October.

- 1990 "Climatic Constraints on Hominid Pelvic Anatomy", in American Anthropological Association Symposium "Pelvic Anatomy, Obstetrics, and Hominid Evolution", R.G. Tague, organizer. New Orleans, November.
- 1991 "Robusticity in the Genus *Homo*", Department of Cell Biology and Anatomy, The Johns Hopkins University Medical School, February.
- 1991 "Assessing and Interpreting Physical Activity in Prehistoric Populations", in Human Biology Council Symposium "Physical Activity and Human Biology", S. Pfeiffer, organizer, Milwaukee, April.
- 1991 "Effects of Exercise on Osteoporosis", Johns Hopkins Medical Institutions Bone Club meeting, May.
- 1992 "Interpreting Postcranial Robusticity in Recent and Earlier *Homo*", Department of Anthropology, University of New Mexico, Albuquerque, March.
- 1992 "Climate and Variation in Human Body Form", Dept. Anatomy, Makerere University School of Medicine, Kampala, Uganda, July.
- 1993 "Bilateral Asymmetry and Mechanical Adaptation of Bone", Johns Hopkins Medical Institutions Bone Club meeting, March.
- 1993 "Postcranial Robusticity in the Genus *Homo*", Department of Anthropology, University of Pennsylvania, Philadelphia, March.
- 1993 "Climatic Adaptations in Human Evolution", Department of Anthropology, Smithsonian Institution, Washington, DC, May.
- 1993 "Biomechanics as an Approach to Skeletal Biology", Department of Anthropology, University of Tennessee, Knoxville, September.
- 1993 "Climate and Body Form in Human Evolution", Department of Anthropology, University of Tennessee, Knoxville, September.
- 1994 "Body Form as a Response to Climate: What Happens When We're Left Out in the Cold", Smithsonian Campus on the Mall, Washington, DC, June.
- 1994 "Climate and Human Evolution", Department of Anthropology, Northern Illinois University, DeKalb, September.
- 1994 "Biomechanics of the Hip in Early *Homo*", Department of Anthropology, Northern Illinois University, DeKalb, September.

- 1994 "Birth and Human Evolution, or Why Was Early Homo So Hip?", Department of Cell Biology and Anatomy, The Johns Hopkins University Medical School, October.
- 1995 "The Ontogeny of Robusticity", Department of Orthopedic Surgery, SUNY Stonybrook, January.
- 1995 "The Evolution of Birth, or What Made Early *Homo* so Hip?", Department of Anatomical Sciences, SUNY Stonybrook, January.
- 1995 "Evolution of the Hominid Hip", presented at the "Primate Locomotion - 1995" Conference, Davis, CA, March.
- 1995 "Climate, Body Size and Body Shape in Human Evolution", Department of Anthropology, CUNY Graduate Center, New York, April.
- 1995 "Birth and Biomechanics of the Hip in Early *Homo*", Department of Anthropology, NYU, New York, April.
- 1995 "Climatic Adaptation in Human Evolution", Quaternary Studies Group, Rutgers University, New Brunswick, April.
- 1996 "Body Size and Encephalization in *Homo*", Department of Biological Anthropology and Anatomy, Duke University, Durham, March.
- 1996 "Brains, Bodies, and Bipedality in Hominid Evolution", Department of Cell Biology and Anatomy, The Johns Hopkins University Medical School, October.
- 1997 "Body Size and Body Shape in Hominid Evolution", Department of Anthropology, Smithsonian Institution, Washington, DC, November.
- 1998 "The Evolution of Hominid Body Form and Robusticity", Summer Workshop, Complutense University, "La Vida en la Prehistoria: La Paleobiología de Nuestros Antepasados", El Escorial, Spain, August.
- 1999 "The Significance of Skeletal 'Robustness' in Human Evolutionary Studies", and "Climate and the Evolution of Human Body Form", Dept. Anthropology, Pennsylvania State University, October.
- 1999 "The Evolution of Human Gait", Fall meeting of the La Jolla Initiative for Explaining the Origins of Humans (LOH), San Diego, November.

- 2000 “Physiology, II: Skeletal”, in “Surgery for Engineers”, a course offered through the Engineering Research Center for Computer Integrated Surgical Systems and Technology, The Johns Hopkins University, January.
- 2001 “Does Size Matter? Reconstructing Body Mass in the Human Fossil Record”, Department of Anthropology, Washington University, St. Louis, November.
- 2002 “Does the Hominin Bipedal Pelvis Promote or Impair Human Reproductive Success?” Spring meeting of the La Jolla Initiative for Explaining the Origins of Humans (LOH), San Diego, March.
- 2002 “Reconstruction of Body Size, Body Shape, and Behavior in the Hominin Fossil Record”, Paleoanthropology Seminar, Smithsonian Institution, Washington, DC, April.
- 2003 “The Development of Bone Strength in Children and Adolescents: A Longitudinal Analysis”, Pediatric Working Group Session, American Society for Bone and Mineral Research, Minneapolis, September.
- 2004 "Skeletal Adaptation to Mechanical Loading During Growth and Development", Children’s Hospital of Philadelphia Nutrition Center Seminar Series, Philadelphia, May.
- 2004 “Trends in the Evolution of the Postcranial Skeleton in the Genus *Homo*”, Fall meeting of the La Jolla Initiative for Explaining the Origins of Humans (LOH), San Diego, November.
- 2004 “The Interpretation of Long Bone Robusticity in Hominin Evolution”, Arizona State University IGERT Program on Neural and Musculoskeletal Adaptation in Form and Function, Tempe, November.
- 2005 “Mechanical Influences on Skeletal Development”, Department of Anthropology, SUNY Albany, March.
- 2005 “Bone Anthropology”, Midwest Symposium on Pediatric Bone Health, Children’s Hospital, Omaha, April.
- 2006 “The Applicability of ‘Wolff’s Law’ to Paleontological Inference”, in meeting sponsored by the National Evolutionary Synthesis Center, “Behavioral Reconstruction in Paleoanthropology”, Durham, NC, February.

2006

“Interpreting the Juvenile Skeleton”, Department of Anthropology,
Ohio State University, June.

PUBLICATIONS

1. Ruff, C.B. (1980) Age differences in craniofacial dimensions among adults from Indian Knoll, Kentucky. *Am. J. Phys. Anthropol.*, 53: 101-108.
2. Ruff, C.B. (1981) A reassessment of demographic estimates for Pecos Pueblo. *Am. J. Phys. Anthropol.*, 54: 147-151.
3. Ruff, C.B. and Jones, H.H. (1981) Bilateral asymmetry in cortical bone of the humerus and tibia - sex and age factors. *Human Biology*, 53: 69-86.
4. Hayes, W.C., Snyder, B., Ruff, C.B., Ramaswamy, S., and White, A.A. III (1981) Some mechanics of bone architecture. In: *Osteoporosis: Recent advances in Pathogenesis and Treatment*, Deluca, H.F., Frost, H.M., Jee, W.S.S., Johnston, C.C., and Parfitt, A.M., eds., pp. 161-174. Baltimore: University Park Press.
5. Ruff, C.B. (1981) Structural Changes in the Lower Limb Bones with Aging at Pecos Pueblo. Ph.D. Thesis, University of Pennsylvania. Ann Arbor: University Microfilms International #8127066.
6. Ruff, C.B. and Hayes, W.C. (1982) Subperiosteal expansion and cortical remodeling of the human femur and tibia with aging. *Science*, 217: 945-948.
7. Ruff, C.B. and Hayes, W.C. (1983) Cross-sectional geometry of Pecos Pueblo femora and tibiae - a biomechanical investigation. I. Method and general patterns of variation. *Am. J. Phys. Anthropol.*, 60: 359-381.
8. Ruff, C.B. and Hayes, W.C. (1983) Cross-sectional geometry of Pecos Pueblo femora and tibiae - a biomechanical investigation. II. Sex, age and side differences. *Am. J. Phys. Anthropol.*, 60: 383-400.
9. Ruff, C.B. (1983) The contribution of cancellous bone to long bone strength and rigidity. *Am. J. Phys. Anthropol.*, 61: 141-143.
10. Ruff, C.B., Larsen, C.S., and Hayes, W.C. (1984) Structural changes in the femur with the transition to agriculture on the Georgia coast. *Am. J. Phys. Anthropol.*, 64: 125-136.
11. Ruff, C.B., and Hayes, W.C. (1984) Bone mineral content in the lower limb: relationship to cross-sectional geometry. *J. Bone Jt. Surg.*, 66A: 1024-1031.
12. Ruff, C.B. and Hayes, W.C. (1984) Age changes in geometry and mineral content of the lower limb bones. *Ann. Biomed. Eng.*, 12: 573-584.
13. Ruff, C.B. (1984) Allometry between length and cross-sectional dimensions of the femur and tibia in *Homo sapiens sapiens*. *Am. J. Phys. Anthropol.*, 65: 347-358.

14. Schaffler, M.B., Burr, D.B., Jungers, W.L., and Ruff, C.B. (1985) Structural and mechanical indicators of limb specialization in primates. *Folia Primatol.*, 45: 61-75.
15. Ruff, C.B. and Leo, F.P. (1986) Use of computed tomography in skeletal structural research. *Yrbk. Phys. Anthropol.*, 29: 181-196.
16. Hayes, W.C. and Ruff, C.B. (1986) Biomechanical compensatory mechanisms for age-related changes in cortical bone. In: *Current Concepts of Bone Fragility*, Uhtoff, H.K., ed., pp. 371-377. Berlin: Springer-Verlag.
17. Ruff, C.B. (1987) Structural allometry of the femur and tibia in Hominoidea and *Macaca*. *Folia Primatol.*, 48: 9-49.
18. VanValkenburgh, B. and Ruff, C.B. (1987) Canine tooth strength and killing behavior in large carnivores. *J. Zoology (London)*, 212: 379-397.
19. Ruff, C.B. (1987) Sexual dimorphism in human lower limb bone structure: Relationship to subsistence strategy and sexual division of labor. *J. Human Evol.*, 16: 396-416.
20. Brock, S.L. and Ruff, C.B. (1988) Diachronic patterns of change in structural properties of the femur in the prehistoric American Southwest. *Am. J. Phys. Anthropol.*, 75: 113-127.
21. Ruff, C.B. and Hayes, W.C. (1988) Sex differences in age-related remodeling of the femur and tibia. *J. Orthop. Res.*, 6: 886-896.
22. Ruff, C.B. (1988) Hindlimb articular surface allometry in Hominoidea and *Macaca*, with comparisons to diaphyseal scaling. *J. Human Evol.*, 17: 687-714.
23. Burr, D.B., Ruff, C.B., and Johnston, C. (1989) Structural adaptations of the femur and humerus to arboreal and terrestrial environments in three species of macaque. *Am. J. Phys. Anthropol.*, 79: 357-368.
24. Ruff, C.B., Walker, A., and Teaford, M.F. (1989) Body mass, sexual dimorphism and femoral proportions of *Proconsul* from Rusinga and Mfangano Islands, Kenya. *J. Human Evol.*, 18: 515-536.
25. Trinkaus, E. and Ruff, C.B. (1989) Diaphyseal cross-sectional morphology and biomechanics of the Fond-de-Forêt 1 femur and the Spy 2 femur and tibia. *Bull. Soc. Roy. Bel. Anthropol. Prehist.*, 100: 30-40.
26. Ruff, C.B. (1989) New approaches to structural evolution of limb bones in primates. *Folia Primatol.*, 53: 142-159.
27. Beck, T.J., Ruff, C.B., Warden, K.E., Scott, W.W. Jr., and Rao, G.U. (1990) Predicting femoral neck strength from bone mineral data: A structural approach. *Invest. Radiol.*, 25: 6-18.

28. Burr, D.B., Ruff, C.B., and Thompson, D.D. (1990) Patterns of skeletal histological change through time: Comparison of an archaic Native American population with modern populations. *Anat. Rec.*, 226: 307-313.
29. Larsen, C.S., Schoeninger, M.J., Hutchinson, D.L., Russell, K.F., and Ruff, C.B. (1990) Beyond demographic collapse: Biological adaptation and change in native populations of La Florida. In: *Columbian Consequences, Vol. II: Archaeological and Historical Perspectives on Spanish Borderlands East*, Thomas, D.H., ed. Washington: Smithsonian Institution Press, pp. 409-428.
30. Ruff, C.B. (1990) Body mass and hindlimb bone cross-sectional and articular dimensions in anthropoid primates. In: *Body Size in Mammalian Paleobiology*, Damuth, J. and McFadden, B.J., eds. Cambridge: Cambridge University Press, pp. 119-149.
31. Torchia, M.E. and Ruff, C.B. (1990) Quantitative geometric remodeling of the femoral diaphysis following hip arthroplasty. *J. Orthop. Res.*, 8: 883-891.
32. Ruff, C.B. and Larsen, C.S. (1990) Postcranial biomechanical adaptations to subsistence changes on the Georgia coast. *Anth. Pap. Am. Mus. Nat. Hist.*, 68: 94-120.
33. Fresia, A.E., Ruff, C.B., and Larsen, C.S. (1990) Temporal decline in bilateral asymmetry of the upper limb on the Georgia coast. *Anth. Pap. Am. Mus. Nat. Hist.*, 68: 121-132.
34. Larsen, C.S. and Ruff, C.B. (1991) Biomechanical adaptation and behavior on the prehistoric Georgia coast. In: *What Mean These Bones? Studies in Southeastern Bioarchaeology*. Powell, M.L., Bridges, P.S., and Mires, A.M., eds. Tuscaloosa: Univ. Alabama Press, pp. 102-113.
35. Ruff, C.B. (1991) Aging and Osteoporosis in Native Americans from Pecos Pueblo, New Mexico: Behavioral and Biomechanical Effects. New York: Garland Press.
36. Ruff, C.B. (1991) Climate and body shape in early hominids. *J. Human Evol.*, 20: 81-105.
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ABSTRACTS

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