

Curriculum Vitae

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Education:

A.A., Union Jr. College, Cranford, NJ, 1963
B.A., Lafayette College, Easton, PA, 1965 [psychology, chemistry]
M.A., Princeton University, Princeton, NJ, 1968 [psychology]
Ph.D., Princeton University, Princeton, NJ, 1969 [psychology]
Dissertation title: "Perception of target distance by echolocating bats"

Professional appointments:

Research Assistant, Psychology Department, Lafayette College, 1963-65
Laboratory Instructor, Psychology Department, Lafayette College, 1965
Research Assistant, Auditory Research Labs, Department of Psychology, Princeton University, 1965-66
National Institutes of Health Predoctoral Fellow, Department of Psychology, Princeton University, 1966-68
Visiting Lecturer, Department of Psychology, Hunter College, New York, Spring 1969
Lecturer, Department of Psychology, Princeton University, 1969-70
NIH Postdoctoral Trainee, Auditory Research Labs, Department of Psychology, Princeton University, 1969-71
Assistant Professor, Department of Psychology, Washington University, 1971-76
Research Associate, Central Institute for the Deaf, Summer 1972
Guest Professor, Fachbereich Biologie, Goethe Universitat, Frankfurt, Germany, Summer 1974
Associate Professor, Department of Psychology and Program in Neural Sciences, Washington University, 1976-79
Professor, Department of Psychology and Program in Neural Sciences, Washington University, 1979-80
Professor, Department of Biology and Institute of Neuroscience, University of Oregon, 1980-84
Professor, Department of Psychology and Division of Biology and Medicine, Section of Neurobiology, Brown University, July 1984-September 1993
Director, Graduate Program in Neural Science, Brown University, July 1987-August 1991
Professor, Department of Neuroscience, Brown University, October 1993-present.
Co-Director, BioNavigation Research Center, Doshisha University, Kyoto, Japan, July 2006-2012.
Member, Neurosensing and Bionavigation Center, Doshisha University, Kyoto, Japan, 2011-2014.
Visiting Faculty to Shandong University/Virginia Tech International Laboratory, Jinan, China, July-August 2013, and August-September 2014.
Invited lecturer, Cold Spring Harbor Asia, Suzhou, China, September, 2014.

Publications:

books/monographs:

Simmons, J. A., Fenton, M. B., Ferguson, R. W., Jutting, M., & Palin, J. (1979) *Instrumentation for Research on Animal Ultrasonic Sounds*. Misc. Publ., Royal Ontario Museum, Toronto, Canada.

chapters in books:

- Simmons, J. A. (1969) The sonar of bats. *Psychology Today*, Nov. 1968, 51-57. (Reprinted in: *Readings in Psychology Today* [1969] and *Readings in Experimental Psychology Today* [1969], Del Mar, CA: CRM Books.)
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- Simmons, J. A. (1992) Time-frequency transforms and images of targets in the sonar of bats. In W. Bialek, (Ed.), *1991 Princeton Lectures in Biophysics*. pp. 291-319. NEC Research Institute, Princeton, NJ.
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- Solinsky, J. C., Feeney, J. J., Simmons, J. A., Ferragamo, M., and Haresign, T. (1992) Higher-order statistical applications in acoustics with reference to nonlinear chaos. *3rd International Symposium on Signal Processing and its Applications (Higher-Order Statistical Signal Processing and its Applications; HOSSPA-92)*.
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- Simmons, J. A., Saillant, P. A., Ferragamo, M. J., Haresign, T., Dear, S. P., Fritz, J. B., and McMullen, T. A. Auditory computations for acoustic imaging in bat sonar. (1996) In: H. L. Hawkins, T. A. McMullen, A. N. Popper, R. R. Fay (Eds.) *Auditory Computation*, Springer Handbook on Auditory Research, Springer-Verlag, New York. pp. 401-468.
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- Surlykke, A. Simmons, J. A., and Moss, C. F. (2016). Perceiving the world through echolocation and vision. In *Bat Bioacoustics*, Fenton, M. B., Grinnell, A. D., and Popper, A. N. eds. (Springer, New York) pp. 265-288.
- Simmons J.A. and Simmons, A. M. (2023). Development of models for bat echolocation. In *History of Discoveries about Hearing*, Popper, A. N. and Ketten, D. R. eds. (Springer, New York) in press.

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- Simmons, J. A. (1969) Acoustic radiation patterns for the echolocating bats, *Chilonycteris rubiginosa* and *Eptesicus fuscus*. *J. Acoust. Soc. Amer.*, 46, 1054-1056.
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- Luo, J., Simmons, A. M., Beck, Q. M., Macías, S., Moss, C. M., and Simmons, J. A. (2019). Frequency-modulated up-chirps produce larger evoked responses than down-chirps in the big brown bat auditory brainstem. *J. Acoust. Soc. Am.*, 146, 1672-1684.
- Simmons, J. A., Hiryu, S., and Shriram, U. (2019). Biosonar interpulse intervals and pulse-echo ambiguity in four species of echolocating bats. *J. Exp. Biol.*, 222 jeb195446 doi: 10.1242/jeb.195446.
- Shriram, U., and Simmons, J. A. (2019). Echolocating bats perceive natural-size targets as a unitary class using micro-spectral ripples in echoes. *Behavioral Neuroscience*, 133, 297-304. https://doi.org/10.1037/bne0000315.
- Lee, H., Roan, M. J., Ming, C., Simmons, J. A., and Müller, R. (2019). High-frequency soundfield microphone for the analysis of bat biosonar. *J. Acoust. Soc. Am.*, 146, 4525-4533.
- Simmons, J. A., Yashiro, H., Kohler, A., Riquimaroux, H., Funabiki, K., and Simmons, A. M. (2020). Long-latency optical responses from the dorsal inferior colliculus of Seba's fruit bat. *J. Comp. Physiol. A.*, 206, 831-844.
- Simmons, J. A., Brown, P. E., Vargas-Irwin, C. E., and Simmons, A. M. (2020). Big brown bats are challenged by acoustically-guided flights through a circular tunnel of hoops. *Sci Rep* 10, 832 (2020). https://doi.org/10.1038/s41598-020-57632-4.
- Ming, C., Bates, M. E., and Simmons, J. A. (2020) How frequency hopping suppresses pulse-echo ambiguity in bat biosonar. *Proc. Nat. Acad. Sci.* 117, 17288-17295.
- Simmons, J. A. and Auger, G. (2021) Bat biosonar signals. *J. Acoust. Soc. Am.*, 149, R3. doi: 10.1121/10.0003428 .
- Ming, C., Haro, S., Simmons, A. M., and Simmons, J. A. (2021) A comprehensive computational model of animal biosonar signal processing. *PLoS Comp. Biol.*, 17(2): e1008677. https://doi.org/10.1371/journal.pcbi.1008677.
- Tuninetti, A., Ming, C., Hom, K.N., Simmons, J.A., and Simmons, A.M. (2021). Spatiotemporal patterning of acoustic gaze in echolocating bats navigating gaps in clutter. *iScience* 24, 102353. https://doi.org/10.1016/j.isci.2021.102353.
- Warnecke, M., Simmons, J.A., and Simmons, A.M. (2021). Population coding of echo flow in the big brown bat's auditory midbrain. *Journal of Neurophysiology*. https://doi.org/10.1152/jn.00013.2021.
- Ketten, D.R., Simmons, J.A., Riquimaroux, H., and Simmons, A.M. (2021). Auditory adaptations related to echolocation in air and water. *Frontiers in Ecology and Evolution*. https://doi.org/10.3389/fevo.2021.661216.
- Tuninetti, A., Simmons, A. M., and Simmons, J. A. (2022). Amplitude discrimination is predictably affected by echo frequency filtering in wideband echolocating bats. *J. Acoust. Soc. Am.* 151, 982-991.
- Simmons; A. M., Tuninetti, A., Yeoh, B. M., and Simmons, (2022). J. A. Non-invasive auditory evoked potentials in response to FM sweeps in awake big brown bats. *J. Comp. Physiol. A.* 208, 505-516.

- Ming, C., and Simmons J. A. (2022). Target Geometry Estimation Using Deep Neural Networks in Sonar Sensing. arXiv preprint arXiv:2203.15770.
- Simmons, J.A and Simmons, A. M. (2023) Oscillatory discharges in the auditory midbrain of the big brown bat contribute to coding of echo delay. *J. Comp. Physiol. A.* 209, 173-287.
- Accomando, A.W., Johnson, M.A., McLaughlin, M. A., Simmons, J. A., and Simmons, A. M. (2023) Connexin36 RNA expression in the cochlear nucleus of the echolocating bat, *Eptesicus fuscus*. *Journal of the Association for Research in Otolaryngology*.
doi: <https://doi.org/10.1101/2022.03.23.485527>.

non-refereed journal articles:

- Simmons, J. A. (1968) Echolocation: Auditory cues for range perception in bats. *Proc. 76th Ann. Conv. APA*, 301-302.
- Galambos, R. and Simmons, J. A. (2015) Echolocation in bats. *Scholarpedia*,
http://www.scholarpedia.org/article/Echolocation_in_bats#:~:text=There%20are%20about%20850%20species,bat%2C%20or%20through%20the%20nostrils

book reviews:

- Simmons, J.A. (1996) Bats and their brains. (book review) *Science* 273, 609.

invited lectures:

at scientific meetings (1995-present):

- “Dynamic aspects of neural representation close the gap between behavioral observations and neural mechanisms in bat sonar,” *Nonlinear Dynamics in Neural Systems*, Marine Biological Laboratory, Woods Hole, MA, June 1995
- "What bats 'see' with their sonar," Symposium on Echolocation, *10th International Bat Research Conference*, Boston University, Boston, MA, August 1995.
- “Auditory space and echo-delay images in bat sonar,” *International Society for Neuroethology*, Cambridge University, Cambridge, England, September 1995.
- "Perceptual dimensions of insect prey in bat sonar," *Feeding and Foraging -- a conference in memory of Vincent G. Dethier*, University of Massachusetts, Amherst, MA, October 1995.
- "Neural mechanisms of perception revealed in echolocating bats," *63rd Meeting of Neurosciences Research Program Associates*, Neurosciences Research Institute, La Jolla, CA, March 1996.
- “Bat behavior,” *Neuroscience Workshop, Advanced Research and Development Committee*, Mitre Corporation on behalf of U.S. Government, La Jolla, CA, November 1996.
- “Dynamic mechanisms of perception exhibited by bat biosonar,” *International Workshop on Central Auditory Processing and Neural Modeling*, Kiaosiung, Taiwan, January 1997.
- “Biosonar acoustic imaging for target localization and classification by bats,” *SPIE Annual Meetings, -- Aerosense*, Orlando, FL, April 1997.
- “Time-domain images and time-domain processing in bat sonars,” *XXXIII International Congress of Physiological Sciences*, Lebedev Institute of Military Medical Sciences, St. Petersburg, Russia, July 1997.
- “Dynamic aspects of echo processing in bat sonar,” *Neural Information Processing Systems Workshop—Neurophysiology of Central Auditory Processing*, Breckenridge, Colorado, December 1997.
- “Time domain processing in bat sonar,” *International Titisee Conference—The Role of Time in Neural Processing*, Titisee, Schwarzwald, March 4-8, 1998.
- “Bats as laboratory animals—why and how,” *American Association for Laboratory Animal Science, New England Branch*, Sturbridge, Massachusetts, May 1998.
- “Echo signal-processing and target ranging by the big brown bat, *Eptesicus fuscus*,” *International Biosonar Conference*, Carvoeiro, Portugal, May 27-June 2, 1998.
- “What do bats see with their sonar?” Staff Development Day, Brown University, June 16, 1998.
- “Auditory computations in bat echolocation,” *NATO Advanced Study Institute—Computational Hearing*, Il Cioccio, Tuscany, July 1-13, 1998.

- “Bat biosonar as a model for mine-hunting systems,” *ONR workshop on Broadband Sonar Solutions for Littoral MCM*, Park City, Utah, August 4-6, 1998.
- “Auditory signal-processing transforms for real-time imaging in bat sonar,” *DARPA Resonant Biomimicry Workshop*, Rice University, Houston, Texas, Jan. 13-14, 1999.
- “Biosonar Imaging and Echo Processing Mechanisms,” *JASON 1999 Winter Study*, General Atomics Technologies, La Jolla, California, Jan. 19, 1999.
- “How the bat’s brain makes images of objects from the timing of echoes,” Keynote Lecture, *Boston Area Neuroscience Group*, Boston, Massachusetts, February 2, 1999.
- “The ghost of Gestalt perception is best seen at night: Reconstruction of sharp spatial images from smeared, dispersed auditory time-frequency representations in bat sonar,” *Spatial Cognition Conference*, University of California, Berkeley, California, April 30-May 2, 1999.
- “Signal processing for target imaging,” Applied Physics Laboratory, Johns-Hopkins University, May 14, 1999.
- “Taking the timing of neural responses to extremes: Echo-delay images in bat sonar,” *Sloan Summer Meeting on Theoretical Neuroscience*, Neurosciences Institute, La Jolla, California, July 24-28, 1999.
- “The role of auditory scenes and object flow in echolocation,” *10th International Conference on Perception and Action (ICPAX)*, Edinburgh, August, 1999.
- “The biosonar challenge,” *Ocean Imaging Conference 2000*, Newport, RI, May 3-5, 2000.
- “Spatial perception and orientation by sonar in bats,” *XXVIIth International Congress of Psychology*, Stockholm, July 23-28, 2000.
- “Identification of Neural Biosonar Algorithms for High-Resolution Imaging,” *Office of Naval Research BioSonar Program*, SPAWAR, San Diego, California, July 17, 2001.
- “Keep your ear on the ball: Display of targets in the bat’s sonar receiver,” Tutorial Lecture, Acoustical Society of America, Pittsburgh, PA, June 2, 2002.
- “Biomimetic sound localization,” *Acoustics Microsensors Program*, DARPA, Colorado Springs, Colorado, August 1, 2001.
- “Replication of broadband biosonar mechanisms for high-resolution performance,” *Office of Naval Research BioSonar Program*, SPAWAR, San Diego, California, August 11, 2002.
- “Auditory computations for target imaging in bats,” *Narragansett/Greater-Boston Chapter, Acoustical Society of America*, Seekonk, MA, January 14, 2003.
- “Methods and significance of observing bats in real time,” *1st Conference on Acoustic Communication by Animals*, Acoustical Society of America, Univ. of Maryland, July 27-30, 2003.
- “Wideband multiple-target synthetic-aperture biosonar imaging,” *Office of Naval Research BioSonar Program*, SPAWAR, San Diego, California, August 6-7, 2003.
- “Delay axis of impulse-response images in biosonar,” *Oceans 2003*, San Diego, CA. September 22-26, 2003.
- “Finding targets with glint highlights in bat sonar,” Science, technical innovation and applications in bioacoustics, *Biosonar Workshop*, British Geological Survey, West Berwick, Scotland, May 4-5, 2004.
- “Natural acoustic behavior of animals: session in memory of Donald R. Griffin,” *147th meeting of the Acoustical Society of America*, New York, NY, May 24-28, 2004.
- “Natural behavior of echolocating bats,” *Symposium on echolocation in bats, 7th International Congress, International Society for Neuroethology*, Nyborg, Denmark, August 7, 2004.
- “Dynamics of bullfrog choruses studied by time-delay localization with an acoustic array,” Joint session for bioacoustics, underwater acoustics, and acoustic signal-processing,” *148th meeting of the Acoustical Society of America*, San Diego, CA, November , November 17, 2004.
- “Unconventional algorithms for biosonar imaging in bats,” *CIRCE (European Consortium on biomimetic sonar)*, Alcalá-de-Henares (Madrid), Spain, March 2-4, 2005.
- “The perceptual dimension of target range in echolocating bats,” *Cosyne05 Workshop “Active Sensing: Implications for Sensory Processing*, Snowbird, Utah, May 21-22, 2005.
- “Versatility of natural behavior in echolocating bats,” Invited lecture in D. R. Griffin Symposium, 42nd annual meeting, Animal Behavior Society, August 9, 2005.
- “Mechanisms proposed for SCAT deconvolution in bat sonar,” *150th meeting of the Acoustical Society of America*, Minneapolis, MN, November, 2005
- “The big brown bat’s perceptual dimension of target range,” *150th meeting of the Acoustical Society of America*, Minneapolis, MN, November, 2005

- “Object representation in echolocating bats: recognition of targets from different orientations,”
Caroline M. DeLong, Rebecca Bragg, and James A. Simmons, *150th meeting of the Acoustical Society of America*, Minneapolis, MN, November, 2005
- “Detection of objects in complex environments by echolocating big brown bats,” Caroline M. DeLong, Sarah Stamper, and James A. Simmons, *151st meeting of the Acoustical Society of America*, Honolulu, HI, November, 2006
- “Biomimetic synthetic-aperture sonar system for ,” Biological approaches to Engineering Conference, Southampton, UK, March, 2008
- “Effects of environmental sounds on bat sonar,” James A. Simmons, 9th Congress of the International Commission on Biological Effects of Noise, Foxwoods, CT, July 2008
- “Matching of echoes to broadcast templates in bat sonar,” Acoustical Society of America, Workshop on Animal Acoustic Communication, Corvallis, OR, August 2008
- “Perception of echoes with FM1-FM2 delay disparities: Bats have selective direction-of-gaze high-resolution imaging,” 156th Meeting, Acoustical Society of America, Miami, FL, November 2008
- “Computational approaches to bat sonar,” Systems Complexity Project (ERATO), Tokyo, University, Tokyo, Japan, November 2008
- “Perceptual fovea for sonar imaging in bats,” Acoustical Society of Japan, Animal Bioacoustics, Karatsu, Kyushu, Japan, December 2008
- “Three sonars in one bat: Layered biosonar images with unified spatial dimensions,” 5th Loughborough Bioacoustics Conference, Loughborough, UK, March, 2009
- “Clutter rejection by FM bats based on convergence of time and spectral cues for perception of echo delay,” 5th Animal International Sonar Conference, Kyoto, Japan, September 2009.
- “Spoiling the image: Spectral deconvolution serves for both shape perception and clutter rejection by FM echolocating bats,” Acoustical Society of America, Narragansett Chapter, with Brain Sciences Program and Division of Engineering Brown University, April, 2009.
- “Perception of shape and rejection of clutter are reciprocal processes in FM bat sonar” (with Mary E. Bates) International Society for Neuroethology, Salamanca, Spain, August 2010.
- “How does bat sonar work?” Shandong University, Jinan, China, August, 2010.
- “Defocusing of biosonar images for clutter rejection,” Systems Complexity Project (ERATO), Tokyo, University, Tokyo, Japan, November 2010.
- “Auditory mechanisms in biosonar,” Boston University, Hearing Research Center, Boston, September, 2011.
- “Acoustic, Neuronal, And Perceptual Components Of Clutter Rejection In Bat Sonar,” Taiwan National Normal University, Taipei, October 2011.
- “Directionality of biosonar and clutter rejection,” Doshisha University, Faculty of Life and Medical Sciences, Kyotanabe, Japan, November, 2011.
- “FM bats use transform-based sonar imaging,” Tokyo University, Kobama, Tokyo, Japan, November, 2011.
- “Transform based sonar imaging in FM echolocating bats,” Doshisha University, Neurosensing and Bionavigation Research Center, Kyotanabe, Japan, December, 2011.
- “Bio-Inspired science and technology in the neuroscience of bat sonar,” New Horizons Colloquium: Virginia Tech (ICTAS), Blacksburg, VA, October, 2012.
- “Front-looking and side-looking receiving beams for biosonar imaging and flight guidance.” Acoustical Society of America 166th meeting, San Francisco, CA, Dec. 3, 2013.
- “Animal Biosonar,” Acoustical Society of America 166th meeting, San Francisco, CA, Hot Topics newsworthy research findings, Dec. 4, 2013.
- “Biosonar auditory model for target shape perception and clutter rejection.” Acoustical Society of America, 167th meeting, Providence, RI, May 5, 2014.
- “Segregation of ambiguous pulse-echo streams and suppression of clutter masking in FM bat sonar.” Acoustical Society of America, 168th meeting, Indianapolis, IN, Oct. 30, 2014.
- “Albert Feng and target ranging in bat sonar.” Acoustical Society of America, 170th meeting, Jacksonville, FL, Nov. 2, 2015.

- “Fish hearing and bat sonar.” Acoustical Society of America, 171st meeting, Salt Lake City, UT, May 23, 2016.
- “Bat sonar, clutter and engineering.” Dept. of Electrical, Computer and Biomedical Engineering, University of Rhode Island, Sept. 21, 2016.
- “Neural representation of sonar emissions and echoes in the auditory midbrain of the echolocating bat, *Eptesicus fuscus*. Acoustical Society of America, 172nd meeting, Honolulu, Hawaii, Nov. 30, 2016.
- “Isolating target shape imaging from target ranging in bat sonar.” 3rd Annual Meeting, Society for Bioacoustics, Irigo, Japan, Dec. 10, 2016.
- “Where is the target in the bat?” Active Sensing: From Animals to Robots, Weizmann Institute of Science, Rehovot, Israel, Jan. 18, 2023.

at universities and other institutions (before 1995):

American Museum of Natural History, New York, NY
 American Institute of Aeronautics and Astronautics, Phoenix Section, Phoenix, AZ
 Applied Research Laboratories, University of Texas, Austin, TX
 Bendix Research Center, Allied Signal Corp., Columbia, MD
 Brandeis University
 Brown University
 Carlton University
 Central Institute for the Deaf, St. Louis, MO
 CCNY
 CNRS Grenoble
 CNRS Jouy-en-Josas
 CNRS Marseilles
 Connecticut College
 Cornell University
 Downstate Medical Center, Brooklyn, NY
 Duke University
 Eaton-Peabody Laboratory, Massachusetts Eye and Ear Infirmary, Boston, MA
 Florida State University
 Ft. Monmouth, N.J., U.S. Army Signal Corps
 Gettysburg College
 IBM Research Center, Poughkeepsie, NY
 Indiana University, Bloomington, IN
 Institut de Chemie et Physique Industrielles de Lyon
 Harvard University
 Haskins Laboratories, New Haven, CT
 Hunter College, CUNY
 Lafayette College
 Loyola University, Chicago
 Massachusetts Institute of Technology
 Max Planck Institut für Verhaltens-Physiologie, Seewiesen, Germany
 McMasters University
 Middlebury College
 Motorola Research and Development Center, Tempe, AZ
 Naval Reserve Research Unit, E. I. DuPont de Nemours, Wilmington, DE
 Naval Research Laboratories, Anacostia, MD
 Naval Undersea Center, San Diego
 NEC Research Laboratories, Princeton, NJ
 New York Zoological Society (Bronx Zoo)
 Oregon State University
 Pennsylvania State University

Picatinny Arsenal, N.J., U.S. Army Ordnance Laboratory
 Princeton University
 Purdue University
 Queen Mary College, University of London
 Queens University, Kingston, Ontario
 Raytheon Submarine Signal Div., Middletown, RI
 Rockefeller University
 Rockefeller University Millbrook Field Station
 Rutgers University, Institute of Animal Behavior, Newark, NJ
 San Diego State University
 Smith-Kettlewell Vision Research Institute, San Francisco, CA
 Salk Institute, La Jolla, CA
 Smithsonian Tropical Research Institute, Panama City, Panama
 Southern Methodist University, Dallas, TX
 SPAWAR, U.S. Navy Space and Naval Warfare Center, San Diego
 St. Louis University
 Stanford University
 SUNY Stony Brook
 U.S. Coast Guard Academy, New London, CT
 University of Aarhus, Denmark
 University of California, Berkeley
 University of California, Irvine
 UCLA
 UCSD
 University of Chicago
 University of Colorado, Boulder
 University of Connecticut
 University of Frankfurt
 University of Maine, Orono
 University of Maryland
 University of Minnesota
 University of Missouri, Columbia
 University of Missouri, St. Louis
 University of Munich
 University of New Mexico, Albuquerque
 University of Aarhus, Denmark
 University of Odense, Denmark
 University of Oregon
 University of Pennsylvania
 University of Pittsburgh
 University of Rochester
 University of Texas, Austin
 University of Tübingen
 University of Virginia
 Washington University in St. Louis
 Woods Hole Marine Biology Institute
 Woods Hole Oceanographic Institute
 Yale University
 York University, Toronto, Ontario

at universities and other institutions (1995-present):

Department of Physiological Sciences, UCLA, Los Angeles, CA, Fall 1995.
 Keck Center for Integrative Neurosciences and Coleman Laboratory, University of California, San Francisco, CA, March 1995.

Department of Psychology, Johns-Hopkins University, Baltimore, MD, April 1995.
 Department of Psychology, Rutgers University, New Brunswick, NJ, April 1995.
 Departments of Zoology and Psychology, University of Maine, Orono, ME, May 1995.
 Department of Physics, University of Michigan, Ann Arbor, MI, March 1996.
 Kresge Hearing Research Laboratory, University of Michigan, Ann Arbor, MI, March 1996.
 Department of Physiology and Biophysics, and Beckman Institute for Complex Systems, University of Illinois, Champaign-Urbana, IL, April 1996.
 Department of Electrical Engineering, Duke University, Durham, NC, October 1996.
 Program in Neuroscience, University of Massachusetts, Amherst, MA, March 1997.
 Brandeis University, 1998.
 Zoological Institute, University of Munich, Munich, Germany, March 1998.
 Department of Biology, University of Tübingen, Tübingen, Germany, March 1998.
 Rand Corporation, Santa Monica, CA. Spring 2000.
 Center for Adaptive Systems/Center for Cognitive and Neural Systems, Boston University, February 4, 2000.
 Animal Behavior lecture, Department of Biology, Boston College, April 5, 2000.
 Perspectives in Neuroscience Series, Center for Neuroscience, Univ. of California, Davis, March 8, 2001.
 Department of Neurobiology, Stanford University, March 9, 2001.
 Animal Behavior seminar class, Department of Physiological Sciences, UCLA, April 19, 2001
 Sloan Center for Theoretical Neurobiology, Division of Biology, California Institute of Technology, California Institute of Technology, April 20, 2001.
 Center for Language and Speech Processing, Johns Hopkins University, Sept. 25, 2001
 Whitaker Biomedical Engineering Institute, Johns Hopkins University, May 5, 2002.
 Hearing Research Center, Boston University, January 31, 2003.
 Animal Behavior Program, Univ. of California, Davis, March, 2003.
 Department of Biology, Pace University, March 3, 2004.
 Program in Neurobiology, Columbia University, March 5, 2004
 Department of Psychology, University of St. Andrews, St. Andrews, Scotland, May 8, 2004.
 U.S. Naval Undersea Warfare Center, Newport, RI, Autumn 2004.
 Woods Hole Oceanographic Institution, December 7, 2005.
 Department of Psychology, Connecticut College, New London, CT, February 14, 2005.
 Program in Neuroscience and Behavior, University of Maryland, March 11, 2005.
 Department of Environment and Technology Management, University of Antwerp, Belgium, January 24, 2006.
 Dept. of Electrical Engineering, Univ. of Massachusetts, Dartmouth, April 7, 2006
 Dept. of Knowledge Engineering and Computer Science, Doshisha University, Kyoto, Japan, April 14, 2006
 Tohoku Gakuin University, Sendai, Japan, April 19, 2006
 Friday Public Lecture Series, Rockefeller University, New York City, September, 2006
 Department of Biology, Texas A&M University, College Station, TX, October, 2006
 Department of Biology, University of Western Ontario, London, Ontario, December, 2006
 Ministry of Defense Science and Technology Laboratory, Southampton, U. K. March, 2007
 Neuroscience Program. Lafayette College, Easton, PA, March, 2007
 Dept. of Biological Sciences, Singapore National University, Singapore, December 2007
 Tokyo University, Aihara Lab, November, 2008
 Doshisha University, Auditory Research Forum, Biwa-Ko, Kitakomatsu, Otsu, Japan, December, 2008.
 WissenschaftsKolleg, Gruenewald, Berlin, Germany, March 2009.
 Doshisha University, Auditory Research Forum, Biwa-Ko, Kitakomatsu, Otsu, Japan, December, 2009.
 Doshisha University, Auditory Research Forum, Biwa-Ko, Kitakomatsu, Otsu, Japan, December, 2011.
 Harvard University, Spring Neuroscience Symposium: May 21, 2013. *Temporal binding for biosonar imaging.*
 Doshisha University, Auditory Research Forum, Kitakomatsu, Japan. Dec. 14, 2013. *Target shape perception and clutter rejection use the same mechanism in bat sonar.*
 Hokkaido University, Animal Sonar Workshop, Sapporo, Japan, July 26, 2014, *Computational structure of wideband biosonar imaging.*

Cold Spring Harbor Asia, Suzhou, China, Sept. 15-19, 2014, *Neurobiology: Diverse Species and Conserved Principles. Perception, attention, and the temporal binding hypothesis.*

Tokyo University, Neuroethology workshop, Dec., 2014, *Amplitude-latency trading in auditory processing.*

Doshisha University, Kyoto, Japan, Dec. 12, 2014. *How echolocating bats prevent clutter interference.*

Doshisha University, Auditory Research Forum, Kitakomatsu, Japan. Dec. 13, 2014, *Target shape perception and clutter rejection use the same mechanism in bat sonar.*

Syracuse University, Biology Graduate Student Spring Seminar, April 9, 2015. *Bat sonar reveals how attention works.*

Johns Hopkins University, April 22, 2015. *Bat sonar as a technological model for how perception happens.*

Dept. of Electrical, Computer and Biomedical Engineering, University of Rhode Island, Sept. 21, 2016. *Bat sonar, clutter and engineering.*

WissenschaftsKolleg, Gruenewald, Berlin, Germany, March 2017.

Bat echolocation symposium, Tucson, AZ, March 2017..

Kavli Physics Institute, Hearing17, Univ. of California Santa Barbara, July 2017.

Harold W. Beams Lecture, Department of Biology, University of Iowa, March 2022.

patents:

Waggoner, T. C., Simmons, J. A., Perry M. K., & Tromel, R. H. (1986) *Apparatus and method for vibratory signal detection.* U.S. Patent No. 4,629,834, U.S. Patent Office, Washington, DC.

Simmons, J. A. (1987) *Apparatus and method for analyzing acoustic signals.* U.S. Patent No. 4,640,134, U.S. Patent Office, Washington, DC.

Media presentations:

“Rats, Bats, and Bugs,” The History Channel. 3-hour TV program on technological applications derived from biology. Our research on echolocation was a major feature of the hour-long “Bats” segment. First broadcast in October 2003 (Halloween).

“Superbat,” Discovery Channel (Gedeon Productions, France) and BBC (English version). 1 hour TV program on the history of discoveries about how bats find their way with sonar. Broadcast in France in January 2004, in United Kingdom in March 2004. Won the world gold medal in the New York Movie and Video Festival, February, 2005; to be aired in U.S in Fall 2005.

“Sonic Magic,” in the series, The Nature of Things. Videotaped on July 2, 2015, and aired on CBC (Canadian) TV Nov. 12, 2015; aired in US, winter 2015-6.

“Echolocation,” SciToons, an animated explanation of biosonar made by Brown students in my lab. (<https://www.youtube.com/watch?v=laeE4icRYp4>).

Service:

to the University:

Member, Brown University Biosafety Committee (1987-2015)

Member, Brown University Public Safety Oversight Committee (2006-present)

Member, Brown University Officer Conduct Review Board (2006-present)

to the profession:

Associate Editor for Animal Bioacoustics, *Journal of the Acoustical Society of America*, February 2004 to 2-13.

Member of Editorial Board, *Bioinspiration and Biomimetics*, 2005 to 2010.

Member, Medals and Awards Committee, Acoustical Society of America, (2007-2015)

Membership in professional societies:

Acoustical Society of America
 Association for Research in Otolaryngology
 American Association for the Advancement of Science
 Society for Neuroscience
 International Society for Neuroethology
 North American Bat Research Symposium
 Acoustical Society of Japan
 Society for Bioacoustics (Japan)

Academic honors, fellowships, honorary societies:

Herbert W. Rogers Psychology Prize, Lafayette College Psychology Department, 1965

NIMH Research Scientist Development Award (Level II), 9/1/84-7/31/95

Inaugural Invited Lectureship, Sprague Lecture Series, University of Pennsylvania, Mahoney Institute of Neuroscience

Elected Fellow of the Acoustical Society of America, 1996

Elected Fellow of the American Association for the Advancement of Science, 2000

Helmholtz Invited Lectureship, University of Utrecht, Netherlands, April, 2002

Appointed member of Technical Committee on Animal Bioacoustics, Acoustical Society of America 2001-2004

Tutorial Lecture, 143rd Meeting of the Acoustical Society of America, Pittsburgh, PA, June, 2002.

Silver Medal in Animal Bioacoustics, Acoustical Society of America, November, 2005 (see citation below)

Heiligenberg Lecture, 10th International Congress of Neuroethology, University of Maryland, College Park, MD, August, 2012).

Gerrit S. Miller, Jr. Award, North American Society for Bat Research, given August, 2013.

Elected Fellow, International Society for Neuroethology, Montevideo, Uruguay, March, 2016.

ACOUSTICAL SOCIETY OF AMERICA
Silver Medal in Animal Bioacoustics
James A. Simmons
2005

The Silver Medal is presented to individuals, without age limitation, for contributions to the advancement of science, engineering, or human welfare through the application of acoustic principles, or through research accomplishment in acoustics. The previous recipient is Whitlow W. L. Au—1998.

CITATION FOR JAMES A. SIMMONS

for contributions to understanding bat echolocation

MINNEAPOLIS, MINNESOTA • 19 OCTOBER 2005

James A. Simmons is an eminent scholar and pioneer in the field of Biosonar, and his research includes sophisticated behavioral and neurophysiological studies of sound processing in the echolocating bat. For over three decades, he has been in the forefront of bat echolocation research, spanning the time between his graduate research to the present.

Jim obtained his bachelor's degree from Lafayette College in Easton, Pennsylvania in 1965 with a double major in Psychology and Chemistry. He then earned a master's degree in 1968 and a Ph.D. in Psychology in 1969 from Princeton University. Jim's graduate research involved studies of echolocation in bats, under the mentorship of E. Glen Wever, one of the giants in physiological acoustics. At that time, acceptance of the processes underlying spatial perception by echolocation was not universal, and one of the exciting moments of his graduate training came when a skeptical Nobel Laureate, Georg von Békésy, on one of his periodic visits to Wever's lab, came to see the behaving bats in "Building B." The demonstration that Jim conducted not only convinced Békésy that bats echolocated but that they also use echo delay to estimate target distance. It was not until some years later that Jim found out that this was a set-up engineered by Wever and by Donald R. Griffin, who was then at the Rockefeller University, to convince Békésy about the bat's extraordinary use of echolocation to determine target range. Jim's dissertation was entitled "Perception of target distance by echolocating bats." After receiving his Ph.D., Jim remained at Princeton University as a National Institutes of Health _NIH_ Postdoctoral trainee for two years.

Jim continued his research on bat echolocation after he moved to Washington University in St. Louis, Missouri in 1971, as an assistant professor in the Neural Science Program that was housed in the Psychology Department. Between 1980 and 1984, he taught and conducted research as a professor in the Department of Biology and Institute of Neuroscience, University of Oregon in Eugene, Oregon. In 1984, Jim moved to Brown University in Providence, Rhode Island, where his wife Andrea had been hired as an assistant professor in the Psychology Department. Both are now professors in the Psychology and Neuroscience Departments at Brown University, respectively. Jim developed methods for conducting psychophysical studies of sonar processing by bats, and researchers around the world have adopted these methods to address a wide range of research questions. Jim was the first to use electronically delayed playbacks of the bat's echolocation signals to simulate target echoes for the study of perception in bats. He used such "phantom" target echoes to measure, for the first time, target range difference discrimination thresholds of echolocating bats. Jim studied sonar ranging performance in bats by determining the minimum difference in echo delay that an echolocating animal can discriminate. With this paradigm, Jim estimated that bats can discriminate a range difference of approximately 1 centimeter, corresponding to an echo delay difference of approximately 60 microseconds.

Jim continued to study sonar ranging performance in echolocating bats, and in the late 1970's, he introduced a new behavioral task, requiring the bat to discriminate a sonar target returning echoes at a fixed delay from one returning echoes that alternated between two delays. In this experiment, Jim found that the echolocating bat can discriminate a jitter in echo delay in the submicrosecond

range, corresponding to a change in target distance of less than 0.1 mm. This result, originally published in 1979 in *Science*, "Perception of echo phase information in bat sonar," demonstrated astonishing ranging accuracy by the echolocating bat. Many researchers in the field

challenged the report, because they asserted it was not biologically possible for the bat's sonar system to discriminate such small time differences at ultrasonic frequencies. Jim continues to work on this problem to explore biological processes that could support sensitivity to small changes in echo delay.

Through clever behavioral experiments, Jim demonstrated time-varying gain in the sonar receiver of echolocating bats. The hearing sensitivity of the big brown bat decreases before each sonar pulse is emitted and then recovers in a logarithmic fashion to compensate for the two-way transmission loss of sonar returns, thereby maintaining a constant echo sensation level over a distance of about 1.5 meters. This is functionally important to the bat, as it stabilizes the bat's estimate of echo arrival time, its cue for target distance.

In addition to Jim's extraordinary contributions to our understanding of perception by sonar, he has conducted groundbreaking neurophysiological experiments in echolocating bats. One of his manuscripts published with co-authors Albert Feng and Shelley Kick in *Science* _1971_, entitled "Echo detection and target-ranging neurons in the auditory system of the bat, *Eptesicus fuscus*," had a profound impact on the study of the neurophysiology of echolocating bats. This paper describes the response properties of auditory neurons in the bat central nervous system that show facilitated responses to pairs of sounds separated by a limited range of biologically relevant delays. These neurons exhibit the response characteristic known as "echo delay-tuning" or "range-tuning," which could provide the neural substrate for target distance coding. The published report on this population of delay-tuned neurons by Simmons and colleagues preceded the first papers by Nobuo Suga and his group, who have since published widely on this topic. There are so many firsts associated with Jim's research that it is difficult to adequately convey the magnitude of his impact on the field of biosonar. His experiments have been theoretically rooted, innovative, and carefully executed. In the past five years, he has used new methods for making thermal infrared video recordings of bats flying in natural situations. He developed a stereo video viewing system that lets him observe bats in 3D and listen to their sounds while they behave. These studies have led to new discoveries that challenge our understanding of echolocation behavior in bats.

Jim has won many awards and honors in his career such as the National Institutes of Health Research Scientist Development Award (9/1/84–7/31/95), and the Herbert W. Rogers Prize, Lafayette College Psychology Department in 1965. He was elected a fellow of the Acoustical Society of America in 1996 and a fellow of the American Association for the Advancement of Science in 2000. Jim presented the tutorial lecture at the 143rd Meeting of the Acoustical Society of America in Pittsburgh, PA, June 2002. He is also one of the associate editors in Animal Bioacoustics for the *Journal of the Acoustical Society of America (JASA)*.

James Simmons is a highly regarded scientist who has published extensively, with over 95 journal articles appearing in prestigious journals including 8 in *Science*, 2 in *Nature*, 20 in *JASA* and 2 in *Acoustics Research Letters Online (ARLO)*. For many of us, to have a single paper published in *Science* or *Nature* would be a tremendous accomplishment. To have 10 manuscripts in these two journals is absolutely astounding. He is also a much sought-after speaker, having been invited to speak at over 85 universities and research institutions throughout the world. An example of the high regard colleagues have of Jim came from a comment by Dr. Prof. Hans Ulrich Schnitzler, who in his own right is an internationally renowned scientist, "Jim Simmons has provoked me to think more than any other individual in the field."

Jim and Andrea are proud parents of their two children, Jessica, a junior art major at Brown, and Ryan, a senior in high school. Both children spent much of their formative years acting as field assistants at bat sites all over the world.

We could not have selected a more deserving individual to receive the Silver Medal in Animal Bioacoustics than James A. Simmons.

WHITLOW W. L. AU
CYNTHIA F. MOSS