Dr. Stephen L. Buchmann
Biographical sketch (mini-CV)
Position title: Affiliate Scientist/Adjunct Professor

Melittologist, Pollination Ecologist
Departments of Entomology
and Ecology and Evolutionary Biology
University of Arizona
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Education/Training:

California State University, Fullerton	B.A.	1974	Biological Sciences
California State University, Fullteron	M.A.	1975	Biological Sciences
University of California, Davis	Ph.D.	1978	Entomology (Botany, minor)

Employment & Affiliations:

Designated Campus Colleague, Ecology and Evolutionary Biology Department, University of Arizona,1980 - present
Adjunct Associate Professor (Affiliate Scientist), Entomology Department, University of Arizona, 1986-present
Research Associate, The Arizona-Sonora Desert Museum, 1982 - present
Instructor, The Art Institute, The Arizona-Sonora Desert Museum, 2010 - present
International Director, The Pollinator Partnership, San Francisco, CA 2008 - 2012
Scientist-at-Large, The Pollinator Partnership, San Francisco, CA, 2012 - 2015
President, Board of Directors, The Drylands Institute, 2000 – 2015
Former President and Board member, Sonoran Arthropod Studies Institute, Tucson, AZ
The Bee Works, LLC (environmental consulting company), 1999 - 2008, Owner, Tucson, AZ
Research Entomologist, USDA-ARS, Carl Hayden Bee Research Center, 1979 - 2000
Part-Time Faculty, Lecturer, California State University, Fullerton, 1973-1975

Honors:

Fellow, Linnean Society of London, 1980 - present
Sigma Xi, 1980 - present
Member, Center for Insect Science, The University of Arizona, Tucson, AZ
Weisman Fellowship, Visiting Professor, Hebrew University, 1990
Visiting Fellow, CSIRO (Biological Control & Weeds Division), Canberra, Australia, 1994
National Research Council, National Academies of Science, panel member for 18 months, co-author of Status of Pollinators in North America NRC/NAS book, 307 pp., (2007)
Smithsonian Tropical Research Institute, Pre-doctoral and Senior Fellowships (2), 1976, 1990
PMA Benjamin Franklin Award for The Forgotten Pollinators (1997)
National Science Teachers Association Outstanding Science Trade Book Award for Young Adults for Letters from the Hive (2010)
Finalist, Los Angeles Times Book Award, 1996 Best Science Book, for The Forgotten Pollinators
Skipping Stones Honor Award Book, 2008, for The Bee Tree

Paterson Prize, Special Recognition, 2008, for The Bee Tree
Patronym: The Sonoran Desert bee: *Anthophora buchmanni* Engel

Selected Current and Recent Grants:
(Approximately $4.5M in competitive grants)

National Science Foundation (engineering) Grant: “Investigating the Mechanics of Buzz Pollination; A Structural Dynamics Perspective”
2221908. 2022 – 2025. $544,492, Mark Jankauski, PI. Buchmann is a collaborator.

National Science Foundation Grant: “Collaborative Research: The brood cell microbiome of solitary bees: origin, diversity, function, and vulnerability. NSF-DEB 1929499. 2019 – 2022. $498,000. Buchmann is an official collaborator on this award.

USDA-AFRI-NIFA: “Bee-microbe symbioses and their impact on pollinator health”
Grant proposal number: 2018-08601, 2019 – 2022. $490,000. Buchmann is an official collaborator on this project.

National Science Foundation grant “Specialization by bumble bees and the evolution of nutritionally diverse floral rewards” (1257762), 2013-2017, $465,000, Anne Leonard PI, Daniel Papaj and Stephen Buchmann, Co-Principal Investigators and collaborator.

University of Arizona Institute of the Environment, Faculty Exploratory Research Grant: “Using Honey Bees to Monitor Community Flowering Phenology and Climate Change in the Sonoran Desert of Arizona” (Buchmann, Esaias, Thoenes, Cook, Weltzin), 2011-2012, $10,085

USDA-FS Conservation Improvement Grant (69-3A75-10-127): “Holistic Restoration Techniques for Native Wood-nesting Bees: A Test of Novel Habitat Demonstration Projects” (2010 -2013), $82,425 to the Pollinator Partnership, Buchmann was the PI.

Books and Booklets (14) :

Buchmann, S.L. 2023. What a Bee Knows: Exploring the Thoughts, Memories, and Personalities of Bees. 300 pp., Island Press, Washington, D.C. Also, a Japanese language edition.

Buchmann, S.L. and Buzz L. Hoffman. Bees. 2020. A docent training manual for the Arizona-Sonora Desert Museum. 41 pp., privately published. Previous editions: 2010, 2013.

Buchmann, S.L. 2015. The Reason for Flowers: Their History, Culture, Biology, and How They Change Our Lives, Scribner, New York, 342 pp. Paperback edition: 2016. Translated and published into Dutch, Italian, Korean and Chinese.

Buchmann, S.L. 2010. Honey Bees: Letters from the Hive: A History of Bees and Honey. Delacorte Press, an imprint of Random House, Inc., New York

Berenbaum, M. et. al. 2007. Status of Pollinators in North America, Committee on the Status of Pollinators in North America, The National Academies Press, Washington, D.C., 307 pp.

Buchmann, S.L. and D. Cohn. 2007. The Bee Tree. A children's book about Malay honey hunters. Cinco Puntos Press, El Paso, TX. A revised edition of this book was published by Lee & Low Books, New York, 40 pp.

Buchmann, S.L. and Beatriz Moisset. Bee Basics: An Introduction to Our Native Bees. 2010. A USDA Forest Service and Pollinator Partnership Publication, 48 pp.

C. Eardley, D. Roth, J. Clarke, S. Buchmann and B. Gemmill (eds.). 2006. Pollinators and Pollination: A Resource Book for Policy and Practice. Published by the African Pollinator initiative (API), with funding from the US Department of State, 77 pp.

Buchmann, S.L. with B. Repplier. 2005. Letters from the Hive: An Intimate History of Bees, Honey, and Humankind. Bantam Books, Random House, New York, 275 pp.

Villanueva-Gutierez, R., Buchmann, S., Donovan. A.J. and D. Roubik. 2005. Crianza Manejo de la Abeja Xunancab en la Peninsula de Yucatan (Breeding and Management of the Xunan Kab Bee in the Yucatan Peninsula). An outreach booklet in Spanish and Yucatec Mayan languages. In association with El Colegio de la Frontera Sur, Chetumal, Quintana Roo, Mexico and The Bee Works, LLC., Tucson, Arizona. Privately distributed,

Chambers, N., Y. Gray and S.L. Buchmann. 2004. Pollinators of the Sonoran Desert, Arizona-Sonora Desert Museum Press, Tucson, Arizona, Half in English and half in Spanish, 82 pp.

Shepherd, M., S. Buchmann, Vaughan and S. Black. 2003. Pollinator Conservation Handbook, A Xerces Society for Invertebrate Conservation and The Bee Works joint publication, 145 pp., Portland, Oregon.

Buchmann, S.L. and G.P. Nabhan. 1996. The Forgotten Pollinators, Island Press, Washington, D.C., 292 pp. Paperback edition published in 1997.

Matheson, A., S. Buchmann, O'Toole, C., Westrich, P., and I.H. Williams (eds.). 1996. The Conservation of Bees, Linnean Society Symposium Series, No. 18, Academic Press, London, UK, 254 pp.

Selected Peer-reviewed Scientific Publications:
(approximately 230 total peer-reviewed publications)

Xu, Y., Wu, B., Vallejo-Marín, M., Bernhardt, P., Jankauski, M., Li, D.Z., Buchmann, S., Wu, J. and Wang, H., 2025. Vibration mechanics involved in buzz pollination lead to size-dependent associations between bumblebees and *Pedicularis* flowers. *Science China Life Sciences*, pp.1-12.

Ferreira, A.I.S., da Silva, N.F.F., Mesquita, F.N., Rosa, T.C., Buchmann, S.L. and Mesquita-Neto, J.N., 2025. Transformer Models improve the acoustic recognition of buzz-pollinating bee species. *Ecological Informatics*, p.103010.

Buchmann, S.L. and Jankauski, M., 2024. Buzz pollination: Bee bites and floral vibrations. *Current Biology*, *34*(18), pp.R864-R866.

Buchmann, S.L. and Papaj, D.R., 2024. Hung out to dry: diminished flowers offer less to pollinators and us. *New Phytologist*, *244*(3), pp.746-748.

Steffan, S.A., Dharampal, P.S., Kueneman, J.G., Keller, A., Argueta-Guzmán, M.P., McFrederick, Q.S., Buchmann, S.L., Vannette, R.L., Edlund, A.F., Mezera, C.C. and Amon, N., 2024. Microbes, the 'silent third partners' of bee–angiosperm mutualisms. *Trends in Ecology & Evolution*, *39*(1), pp.65-77.

Christensen, S.M., Srinivas, S.N., McFrederick, Q.S., Danforth, B.N., Buchmann, S.L. and Vannette, R.L., 2024. Symbiotic bacteria and fungi proliferate in diapause and may enhance overwintering survival in a solitary bee. *The ISME Journal*, *18*(1), p.wrae089.

Russell, A.L., Buchmann, S.L., Ascher, J.S., Wang, Z., Kriebel, R., Jolles, D.D., Orr, M.C. and Hughes, A.C., 2024. Global patterns and drivers of buzzing bees and poricidal plants. *Current Biology*, *34*(14), pp.3055-3063.

Cruz, T.M.P., Buchmann, S.L. and Prudic, K.L., 2024. Buzzing towards Resilience: Investigating the Spatial Alignment of the Desert Pallid Bee, Centris pallida, and Its Host Plants in Response to Climate Change. *Insects*, *15*(10), p.793.

Balbuena, M.S., Buchmann, S.L., Papaj, D.R. and Raguso, R.A., 2024. Organ-specific volatiles from Sonoran desert Krameria flowers as potential signals for oil-collecting bees. *Phytochemistry*, *218*, p.113937.

Goffinet, A.J., Darragh, K., Saleh, N., Ostwald, M.M., Buchmann, S.L. and Ramirez, S.R., 2024. Individual variation in male pheromone production in Xylocopa sonorina correlates with size and gland color. *Journal of Chemical Ecology*, *50*(1), pp.1-10.

Hammer, T.J., Kueneman, J., Argueta-Guzmán, M., McFrederick, Q.S., Grant, L., Wcislo, W., Buchmann, S. and Danforth, B.N., 2023. Bee breweries: The unusually fermentative, lactobacilli-dominated brood cell microbiomes of cellophane bees. *Frontiers in Microbiology*, *14*, p.1114849.

Jankauski, M., Casey, C., Heveran, C., Busby, M.K. and Buchmann, S., 2022. Carpenter bee thorax vibration and force generation inform pollen release mechanisms during floral buzzing. *Scientific Reports*, *12*(1), p.12654.

Ostwald, M.M., Alba-Tercedor, J., Minckley, R.L. and Buchmann, S.L., 2022. Three-dimensional morphology of the hypertrophied sex pheromone gland in a lek-mating carpenter bee (Xylocopa sonorina) revealed by micro computed tomography and scanning electron microscopy. *Apidologie*, *53*(5), p.60.

Jankauski, M., Ferguson, R., Russell, A. and Buchmann, S., 2022. Structural dynamics of real and modelled Solanum stamens: implications for pollen ejection by buzzing bees. *Journal of the Royal Society Interface*, *19*(188), p.20220040.

de A. Caetano, C., de O. Sabino, W., Cordeiro, G.D., Buchmann, S.L. and Alves-dos-Santos, I., 2022. Scientific note about the negative impacts of male competition on Epicharis albofasciata mating. *Apidologie*, *53*(1), p.1.

Barrett, M., Fischer, B. and Buchmann, S., 2022. *Informing policy and practice on insect pollinator declines: tensions between conservation and animal welfare. Front. Ecol. Evol. 10: 1071251* [online]

Barrett, M., Schneider, S., Sachdeva, P., Gomez, A., Buchmann, S. and O'Donnell, S., 2021. Neuroanatomical differentiation associated with alternative reproductive tactics in male arid land bees, Centris pallida and Amegilla dawsoni. *Journal of Comparative Physiology A*, *207*, pp.497-504.

Sabino, W.O., Alves-dos-Santos, I., Queiroz, E.P., de Faria, L.B., Papaj, D.R., Buchmann, S.L. and da Silva, C.I., 2021. Nesting biology of Centris (Paracentris) burgdorfi (Apidae: Centridini). *Journal of Apicultural Research*, *60*(5), pp.817-827.

Buchmann, S.L. and Minckley, R.L., 2021. Large carpenter bees (Xylocopa). In *Encyclopedia of social insects* (pp. 547-550). Cham: Springer International Publishing.

DeLuca, P.A., S. Buchmann, Candace Galen, A.C. Mason and Mario Vallejo-Marin. 2019. Does body size predict the buzz-pollination frequencies used by bees? Ecology and Evolution. 2019; 1-13. DOI: 10.1002/ece3.5092

Russell, A.L., Buchmann, S.L., Sabino, W.D.O. and Papaj, D.R., 2018. Brawls bring buzz: Male size influences competition and courtship in Diadasia rinconis (Hymenoptera: Apidae). *Journal of Insect Science*, *18*(4), p.18.

Cardinal, S., S.L. Buchmann and A. L. Russell. 2018. The evolution of floral sonication, a pollen foraging behavior used by bees (Anthophila). Evolution 72-3: 590-600.

DeLuca, P.A., N. Giebink, A.C. Mason, D. Papaj and S.L. Buchmann. 2018. How well do acoustic recordings characterize properties of bee (Anthophila) floral sonication vibrations? Bioacoustics, DOI: 10.1080/09524622.2018.1511474

Russell, A.L., S.L. Buchmann, W. de O. Sabino and D. Papaj. 2018. Brawls Bring Buzz: Male Size Influences Competition and Courtship in Diadasia rinconis (Hymenoptera: Apidae). Journal of Insect Scienece, 18(4):18; 1-11.

Cardinal, S., Buchmann, S.L. and Russell, A.L., 2018. The evolution of floral sonication, a pollen foraging behavior used by bees (Anthophila). *Evolution*, *72*(3), pp.590-600.

Russell, A.L., Buchmann, S.L. and Papaj, D.R., 2017. How a generalist bee achieves high efficiency of pollen collection on diverse floral resources. *Behavioral Ecology*, *28*(4), pp.991-1003.

Papaj, D.R., Buchmann, S.L. and Russell, A.L., 2017. Division of labor of anthers in heterantherous plants: flexibility of bee pollen collection behavior may serve to keep plants honest. *Arthropod-Plant Interactions*, *11*, pp.307-315.

Russell, A.L., Buchmann, S.L. and Papaj, D.R., 2017. How a generalist bee achieves high efficiency of pollen collection on diverse floral resources. *Behavioral Ecology*, *28*(4), pp.991-1003.

Gronenberg, W., A. Raikhelkar, E. Absdhire, J. Stevens, E. Epstein, K. Loyola, M. Rauscher and S. Buchmann. 2014. Honeybees (*Apis mellifera*) learn to discriminate the smell of organic compounds from their respective deuterated isotopomers. Proc. R. Soc. B2014 281, 201330989.

King, M.J. and S.L. Buchmann. 2003. Floral Sonication by Bees: Mesosomal Vibration by Bombus and Xylocopa, but Not Apis (Hymenoptera: Apidae), Ejects Pollen from Poricidal Anthers. J. Kans. Entomol. Soc. 76(2):295-305.

King, M.J., S.L. Buchmann and H. Spangler. 1996. Activity of asynchronous flight muscle from two bee families during sonication (buzzing). J. Exp. Biol. 199:2137-2321.

Buchmann, S.L. and J.H. Cane. 1989. Bees assess pollen returns while sonicating Solanum flowers. Oecologia 81:289-294.

Buchmann, S.L. 1983. Buzz Pollination in Angiosperms. In: Handbook of Experimental Pollination Biology, C.E. Jones and R.J. Little (eds.), Scientific and Academic Editions, Van Nostrand Reinhold Company, Inc. New York, pp. 73-113.

Filmography:
(Scientific Consultant and Associate Producer credits)

- *Planet Insect (2024)* – Three-episode series streaming on the Curiosity Channel.
- *The Mating Game* (2021) – BBC Natural History Unit production, narrated by Sir David Attenborough.
- *Wings of Life* (2013) – Disneynature feature film, narrated by Meryl Streep, Produced by Louie Schwartzberg, Buchmann served as Chief Scientist.
- *Honey for the Maya* (2011) – YouTube 8-minute film, produced and directed by S. Buchmann.
- *Life in the Undergrowth* (2005) – BBC Natural History Unit series, narrated by Sir David Attenborough.
- *Living with Bugs: Close Encounters* (2003) – BBC Nature Series, produced by Oxford Scientific Films, UK.
- *Pollinators in Peril* (1999) – Hosted and narrated by Peter Fonda, produced by Red Sky Productions. Commissioned by Turner Original Productions and the World Wildlife Fund. Airing on the TBS Superstation and other Turner Entertainment Group networks. Loosely based on the 1996 book "The Forgotten Pollinators" by Buchmann and Nabhan.
- *The Sonoran Desert: A Violent Eden* (1997) – Part of "The Desert Speaks" series, produced by KUAT Television.