

ANNA REBECCA HOLDEN

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annarholden.com

EDUCATION

The Richard Gilder Graduate School, American Museum of Natural History, New York, NY
PhD Student, Comparative Biology, August 2014

Advisors: Dr. James Carpenter, Division Chair and Peter J. Solomon Family Curator, Division of Invertebrate Zoology; Dr. Melanie Hopkins, Assistant Curator, Invertebrate Paleontology; Dr. Ross MacPhee, Curator Mammology, Division of Vertebrate Zoology; Dr. Scott Elias, Professor of Quaternary Science, Royal Holloway, London.

Harvard University, Cambridge, MA

MLA, Museum Studies (Harvard Extension School), 2006

Thesis: "Bridging the Gap between Nature-Deficient City Youth and Urban Wildlife: An Example of a Museum's Unique Ability to Address a Local Need."
Harvard University Dean's Academic Achievement List

Nonprofit Management Courses (Harvard Extension School), 2006–2007

Hampshire College, Amherst, MA

BA, Combined Studies in Biology and Studio Arts, May 2000

The School of the Museum of Fine Arts, Boston, MA

Courses towards BA

HONORS AND AWARDS

W. M. Keck Carbon Cycle Accelerator Mass Spectrometry Laboratory in the Department of Earth System Science at the University of California, Irvine:

- \$3,300 to radiocarbon date freshwater mollusks and gastropods from the Rancho La Brea Tar Pits. 2017.
- \$16,000 to radiocarbon date insect samples from the Rancho La Brea Tar Pits. 2017.
- \$100,000 to radiocarbon date insect samples from the Rancho La Brea Tar Pits. 2015-2016.
- \$6,000 to radiocarbon date insect and plant samples from the Rancho La Brea Tar Pits. 2014.

Sonoma State University:

- \$350 for travel and presentation.

Research Associate, La Brea Tar Pits and Museum, 2015.

Research Associate, Entomology Section, Natural History Museum of Los Angeles County, 2014.

Natural History Museum of Los Angeles County Funds to Support Individual Research, 2013-2015:

- \$2,700 for publication fees.
- \$500 for travel to the Rancho La Brea Insect Collection for research material.
- \$500 for travel to University of California, Irvine for radiocarbon dating and isotopic analysis of Rancho La Brea insects and plants.
- \$1,000 for computed tomography scans of Rancho La Brea insect material.
- \$1,200 for travel to [see above] select samples for insect research at the Rancho La Brea Insect Collection.

Fellowship, Richard Gilder Graduate School, American Museum of Natural History

- \$138,856, four years. 2014.

National Park Service, Santa Monica Mountains National Recreation Area Invertebrate Inventory:

- \$1,000 for a preliminary spider survey of the Santa Monica Mountains. 2010.

Harvard University Dean's Academic Achievement List. 2006.

RELEVANT PROFESSIONAL EXPERIENCE

The Richard Gilder Graduate School, American Museum of Natural History, New York, NY
Graduate Fellow, 2014 - present

Natural History Museum of Los Angeles, Entomology Section, Los Angeles, CA

Project Manager, 2012 – 2014

Management: Managed an NSF-funded Costa Rican insect biodiversity inventory (ZADBI).

Duties included strategic plan development and budgeting. Collaborated with the Curator of Entomology, an international team of scientists, and Costa Rican staff.

Fieldwork: Collected various target species of flies using specialized traps in multiple localities. Prepared, identified, and curated specimens.

Education: Developed and led outreach and educational activities including online curriculum with supporting materials; helped develop ZADBI website (<http://phorid.net/zadbi>); marketing; publications and blogs.

George C. Page Museum at the La Brea Tar Pits, Los Angeles, CA

Curatorial and Research Assistant, 2012 – 2012

Fieldwork: Collected comparative material including galls; established comparative beetle colonies.

Curatorial duties: Created an inventory and helped develop best curatorial practices for fossil insect specimens.

Research: Conducted research on the Museum's paleoentomology collection, using insects and insect-plant interactions as Pleistocene paleoenvironmental and taphonomic indicators.

Education: Presented research to the Museum staff and Board of Directors; developed outreach information and advised educational staff on how to use fossil insect and plant research in educational programming.

National Park Service/Natural History Museum of Los Angeles, Los Angeles, CA

Associated Researcher, 2009 – 2011

Fieldwork: Surveyed spiders in the Los Angeles and the Santa Monica Mountains in over ten localities to establish a baseline of species to be compared to a Los Angeles spider survey.

Education: Developed and led outreach education including on-site museum programming and field-led citizen science participation.

George C. Page Museum at the La Brea Tar Pits, Los Angeles, CA

Project Coordinator, 2009- 2011

Education: Coordinated daily school visits to the museum; managed volunteers and developed training; public and special event programming; coordinated activities and reading resources for schools and families; collaborated with Research and Collections to enhance educational programming.

National Park Service Boston Harbor Islands/Harvard University Museum of Comparative Zoology, Department of Entomology, Cambridge, MA

Research Assistant and Educator, 2009

Fieldwork: Collected insects from multiple Boston Harbor Islands.

Curatorial duties: Curated, databased specimens, and created a synoptic bee collection.

Education: Combined research on the islands' biodiversity with public education for the Greater Boston Area public schools to foster interest in insects and other invertebrates on the Harbor Islands.

Harvard University Museum of Comparative Zoology, Cambridge, MA
Assistant to Faculty and Collections, Department of Invertebrate Paleontology, 2002- 2009

Fieldwork: Coordinated and conducted fossil fieldwork.

Curatorial duties: Identified and organized visual material such as illustrations and photographs within the collection; scanned, restored and enhanced digital images for presentations and websites; organized and databased fossil collections; prepared fossils with the latest techniques; acquired updated tools and machinery for lab.

Administrative duties: Supported faculty and collection staff in their teaching, research, and professional duties.

Education: Initiated, organized and lead on-site tours of the department's fossil collection with supporting outreach material. Coordinated new educational programs and lectures in conjunction with the Harvard Museum of Natural History. Developed teacher professional development training and special museum events.

Harvard University Extension School, Cambridge, MA
Research Associate to Museum Studies Professor Mary Malloy, 2007 – 2008

Research: Compiled a comprehensive statistical database of all museums in America; created profiles to use in analysis of factors of establishment and sustainability.

Harvard University Museum of Comparative Zoology, Cambridge MA
Lab Technician, Department of Herpetology, 2001- 2002

Lab work: Maintained habitats and coordinated hormonal injections and frog pairings for lab research.

PUBLICATIONS

Peer-Reviewed, Original Research:

Holden, A. R. (2018) "Recent Advances in the Study of Rancho La Brea's Quaternary Insect Collection." In advanced preparation.

Holden, A. R. (2018) "A taphonomic and paleoenvironmental study of Late Pleistocene southern California based on a unique fossil insect assemblage from the Rancho La Brea Tar Pits." In advanced preparation

Holden A. R., Angus, R., Barclay, M. (2017) "Nearctic origins of *Necrobia violecea* (Coleoptera: Cleridae), a species previously considered to be invasive to North America." Under review. *Coleopterists' Bulletin*.

Barclay, M., **Holden, A. R.** Southon, J., Angus, R. (*Author order TBD). (2017) "The chance preservation of subfossil xylophagous beetles within their associated wood substrate: a unique opportunity to test dating methods for wood and insect remains on known synchronous sample." In preparation.

Holden, A. R., Southon, J. R., Will, K., Kirby, M. E., Aalbu, R. L., and Markey, M.J. (2017). "A 50,000 year insect record from Rancho La Brea, southern California: Insights into past climate and fossil deposition." *Quaternary Science Reviews*, 168: 123-136.

Holden, A. R., and Southon, J. R. (2016). "Radiocarbon dating and stable isotopic analysis of insect chitin from the Rancho La Brea Tar Pits, southern California." *Radiocarbon*, 58(01): 99-113.

Holden, A. R., Erwin, Diane M., Schick, K. N., and Gross, J. (2015). "Late Pleistocene galls from the La Brea Tar Pits; Implications for cynipine wasp and native plant distribution in southern California." *Quaternary Research*, 84(3): 358-367.

Holden, A. R., Koch, J. B., Griswold, T., Erwin, D. M., and Hall, J. (2014). "Leafcutter bee nests and pupae from the Rancho La Brea Tar Pits of southern California: Implications for understanding the paleoenvironment of the Late Pleistocene." *PLoS One*, April 9.

Holden, A. R., Harris, J. M. and Timm, R. M., (2013). "Paleoecological and taphonomic implications of insect-damaged Pleistocene vertebrate remains from Rancho La Brea, southern California." *PLoS One*, July 3.

Holden, A. R. and Harris, J. M. (2013). "Late Pleistocene Coleopteran Galleries in Wood from the La Brea Tar Pits: Colonization of Juniper by *Phloeosinus Chapuis* (Curculionidae: Scolytinae) and Buprestidae." *The Coleopterists Bulletin* 67(2):155-160.

Abstracts, Non-Peer Reviewed, Popular Articles:

Holden, A. R. "Enhancing the Utility of Rancho La Brea Insects: Recent Advances in Methods Enable Diverse Lines of Research of the Most Extensive Quaternary Insect Collection for Paleontologists and Neontologists Alike." Presentation for the *Entomological Collections Network Annual Meeting*.

Holden, A. R. "Quaternary Insect Studies at the Rancho La Brea Tar Pits, southern California." Presentation for the *Entomological Society of America Annual Meeting*.

Holden, A. R., Southon, J. "A paleoenvironmental and taphonomic study of Late Pleistocene southern California based on a unique fossil insect assemblage from the Rancho La Brea Tar Pits." Poster for *Entomological Society of America Annual Meeting and the Entomological Collections Network Annual Meeting*.

S. Presslee, S. Lowe, **A. R Holden**, Southon, J. (2017). "Arthropods meet proteomics: The selection of insect samples from museum collections using rapid and reliable protein screening techniques." Presentation for the *Entomological Society of America Annual Meeting*.

Southon, J., **Holden, A. R.** (2017) "Insects are Wood: Sample Preparation of Insect Cuticle for Radiocarbon Dating and Stable Isotope Measurements." Poster for the *14th Annual Conference on Accelerated Mass Spectrometry*.

Presslee, S., Macphee, R. D., Collins, M., Southon, J., **Holden, A. R.**, Farrell, A. (2016) "Radiocarbon Dating and Proteomic Analysis of Highly Purified Bone Collagen Derived from Rancho La Brea Mammal Fossils". Poster for the *Society of Vertebrate Annual Meeting*.

Holden, A. R., Erwin, Diane M., Schick, K., N. and Gross, J. (2016). "Late Pleistocene galls from the La Brea Tar Pits; Implications for cynipine wasp and native plant distribution in southern California." Poster for the *American Quaternary Society 24th Biennial Meeting*.

Holden, A. R., and Southon, J. (2016) "Successful methods to radiocarbon date insect chitin from the La Brea Tar Pits, Southern California." Poster for the *American Quaternary Society 24th Biennial Meeting*.

Holden, A. R., (2016) Erwin, Diane M., Schick, K., N. and Gross, J. (2015). "Late Pleistocene galls from the La Brea Tar Pits; Implications for cynipine wasp and native plant distribution in southern California." Poster for the *American Quaternary Association 24th Biennial Meeting*.

Holden, A. R., Southon, J. (2016) "Successful methods to radiocarbon date insect chitin from the La Brea Tar Pits, Southern California." Presentation for the *American Quaternary Association 24th Biennial Meeting*.

Holden, A. R., Erwin, Diane M., Schick, K., N. and Gross, J. (2015). "Late Pleistocene galls from the La Brea Tar Pits; Implications for cynipine wasp and native plant distribution in southern California." Poster for the *XXXIV Willi Hennig Society Meeting*.

Holden, A. R., and Southon, J. (2015) "Successful methods to radiocarbon date insect chitin from the La Brea Tar Pits, Southern California." Presentation for the *XXXIV Willi Hennig Society Meeting*.

Holden, A.R. (2015). "Nest architecture informs higher-level phylogenetic relationships within megachilid bees (Hymenoptera: Megachilidae)." Presentation for the *XXXIV Willi Hennig Society Meeting*.

Holden, A. R., Harris, J. M. and Timm, R. M., (2013). "Paleoecological and taphonomic implications of insect-damaged Pleistocene vertebrate remains from Rancho La Brea, southern California." Poster for the *73rd Annual Meeting of the Society of Vertebrate Paleontology*.

Holden, A. R., Erwin, D. M., Schick, K. N., Gross, J., and Hall, J. (2013) Traces in asphalt: New observations of Pleistocene plant – insect interactions from the Rancho La Brea Tar Pits, Los Angeles, California, USA. *Botany 2013*.

<http://www.botanyconference.org/engine/search/index.php?func=detail&aid=887>

Schick, K. N., **Holden, A. R.**, Erwin, D. M. (2013) The Cenozoic Record of Galls: A Review. Poster for the *6th International symposium on the biology and ecology of gall inducing arthropods and related endophytes*. <http://6isbegia.org/images/draftprogram4july2sb2013.pdf>. Queensland, Australia.

Holden, A. R., Borkent, A., and Brown, B. V. (2013). "Progress of the Costa Rican ZADBI Project." *Fly Times*, Issue 50.

PRESENTATIONS

"Advances in Quaternary Insect Studies at the Rancho La Brea Tar Pits, southern California." Sonoma State University. 2017.

"Quaternary Insect Studies at the Rancho La Brea Tar Pits, southern California." Pacific Coast Entomological Society Meeting at UC Berkeley. 2017.

"Quaternary Insect Studies at the Rancho La Brea Tar Pits, southern California." Smithsonian Institution. 2017.

"Quaternary Insect Studies at the Rancho La Brea Tar Pits, southern California." British Museum of Natural History. 2017.

"Quaternary Insect Studies at the Rancho La Brea Tar Pits, southern California." Royal Holloway, London. 2017

"Quaternary Insect Studies from the Rancho La Brea Tar Pits, Southern California." Lamont-Doherty Earth Institute, Columbia University. 2016.

“A 50,000 Year Insect Record from Rancho La Brea, Southern California: Insights into Past Climate and Fossil Deposition.” Department of Environmental Science, Policy, and Management, University of California Berkeley. 2016.

“Successful methods to radiocarbon date Quaternary insect chitin from the Rancho La Brea Tar Pits, southern California.” Natural History Museum of Los Angeles County. 2016.

“Fossil Insect Studies at the Rancho La Brea Tar Pits.” La Brea Tar Pits and Museum. 2015.

“Successful methods to radiocarbon date insect chitin from the La Brea Tar Pits, Southern California.” The XXXIV Willi Hennig Society Meeting. 2015

“Nest architecture informs higher-level phylogenetic relationships within megachilid bees (Hymenoptera: Megachilidae).” The XXXIV Willi Hennig Society Meeting. 2015.

FIELDWORK, COLLECTIONS RESEARCH, AND COURSES

Fossil and comparative insect material research: The Essig Museum of Entomology, University of California, Berkeley. March 14-21, 2016; May 29-June 3, 2016; June 8-June 18, 2016; October 7-24; November 27-December 17, 2016; February 3-17; June 13-July 5, 2017; September 27-October 10, 2017.

Fossil and comparative insect material research: California Academy of Sciences, San Francisco, California. March 14-21, 2016; May 29-June 3, 2016; June 8-June 18, 2016; October 7-24, 2016; June 13-July 5, 2017.

Fossil and comparative insect material research: The Smithsonian Institution. January 17-26, 2017.

Fossil and comparative insect material research, beetle fieldwork with Dr. Art V. Evans, Richmond Virginia. January 19-22, 2017.

Fossil and comparative insect material research: Rancho La Brea Tar Pits and Museum/Natural History Museum of Los Angeles County, Los Angeles, California. July 1-16, 2015; November 30, 2015 - December 15, 2016; March 11-14, 2016; June 4-8, 2016; September 23-October 7, 2016.

The Bee Course. Southwestern Research Station. Portal, Arizona. August 26 - September 5, 2015.

Solitary bee field and lab work with Drs. Jerry Rozen. Southwestern Research Station. Portal, Arizona. May 10-18, 2015.

HYM Course CRILAR. Anillaco La Rioja, Argentina. February 28 - March 9, 2015.

The Lepidoptera Course. Southwestern Research Station. Portal, Arizona. August 14 - 23, 2014.

Diptera research for the Entomology Section, Natural History Museum of Los Angeles County. Various localities, Costa Rica. 2012-2014.

ASSOCIATIONS

The American Alliance of Museums
The American Quaternary Association
Entomological Society of America
Entomological Collections Network

Lepidopterists' Society
The Coleopterist's Society

IN THE NEWS

Popular Science

“Los Angeles has enjoyed the same amazing climate for 50,000 years. According to the Beetles, anyway.”

<http://www.popsci.com/los-angeles-climate-50000-years?KMpf2LCH7bFCAA7m.01>

Richmond Public Radio, 88.9FM, "What's Bugging You": “La Brea Beetles Revisited.”

Interview with Dr. Arthur V. Evans, and producer, Steve Clark, for "What's Bugging You", a weekly radio segment on insects, which airs during "Morning Addition".

“Anna Holden is the lead author of a new paper that examines beetle fragments from the La Brea Tar Pits in California. Anna discusses with entomologist Dr. Art Evans and 88.9 WCVE producer Steve Clark about how beetle bits--tens of thousands of years old--can provide insights into the climatic conditions that once prevailed at the Los Angeles Basin.”

<http://ideastations.org/radio/news/la-brea-beetles-revisited>

Richmond Public Radio, 88.9FM, "What's Bugging You": “Insects of the La Brea Tar Pits.”

Interview with Dr. Arthur V. Evans, and producer, Steve Clark, for "What's Bugging You", a weekly radio segment on insects, which airs during "Morning Addition".

“Anna Holden, a doctoral student at the Richard Gilder Graduate School at the American Museum of Natural History in New York, shares her insect research at the La Brea Tar Pits in California.”

<http://ideastations.org/radio/news/insects-la-brea-tar-pits>

Science Magazine:

Drowning in tar, eaten by insects.

<http://news.sciencemag.org/2013/07/scienceshot-drowning-tar-eaten-insects>

Ancient bees pulled from tar pit.

<http://news.sciencemag.org/plants-animals/2014/04/scienceshot-ancient-bees-pulled-tar-pit>

Smithsonian Magazine:

Ice-Age bees uncovered at the La Brea Tar Pits.

<http://www.smithsonianmag.com/smart-news/ice-aged-bees-uncovered-la-brea-tar-pits-180950507/?no-ist>

National Geographic:

Tar pit bees connect California's past to the present.

<http://phenomena.nationalgeographic.com/2014/04/12/tar-pits-bees-connect-californias-past-to-the-present/>

NBC:

Bee fossils provide rare glimpse into Ice Age environment.

http://www.nbcnews.com/id/54923183/ns/technology_and_science-science/t/bee-fossils-provide-rare-glimpse-ice-age-environment/#.VDXmXtylnFI

NPR Science Friday:

Prehistoric leafcutter bee pupae.

<http://www.sciencefriday.com/articles/insect-microfossils-provide-prehistoric-insights/>

Tar Noir: Paleoforensics at the La Brea Tar Pits.

<http://www.sciencefriday.com/video/08/21/2014/tar-noir-paleoforensics-at-the-la-brea-tar-pits.html>

Science News:

La Brea Tar Pits yield exquisite Ice Age bees.

<https://www.sciencenews.org/article/la-brea-tar-pits-yield-exquisite-ice-age-bees>

Science Daily:

Fossil beetles suggest that LA climate has been relatively stable for 50,000 years.

New radiocarbon dating of La Brea Tar Pits beetles indicates that Southern California's Paleoclimate was very similar to today

<https://www.sciencedaily.com/releases/2017/05/170524131134.htm>

Fossil insect traces reveal ancient climate, entrapment, and fossilization at La Brea Tar Pits.

<http://www.sciencedaily.com/releases/2013/07/130703101433.htm>

Science News Daily:

Fossil insect traces reveal ancient climate, entrapment, and fossilization at La Brea Tar Pits.

<http://www.sciencenewsdaily.org/archaeology-fossils-news/cluster388843272/>

Science Magazine News for Kids:

Tar pit bones yield climate clues: Insect damage to ancient bones reveals length of ‘summer’ during the last Ice Age.

<http://www.sciencenewsforkids.org/2013/07/insect-damage-to-ancient-bones-reveals-lengthof-summer-during-the-last-ice-age/>

FOX News:

Bee fossils provide rare glimpse into Ice Age environment.

<http://www.foxnews.com/science/2014/04/11/bee-fossils-provide-rare-glimpse-into-ice-age-environment/>

Los Angeles Times:

A web search in the Santa Monica Mountains.

<http://articles.latimes.com/2010/apr/18/local/la-me-spiders18-2010apr18>

RELEVANT SKILLS

Microsoft Word, Publisher, Excel, PowerPoint and Access, Filemaker Pro, Adobe Photoshop, Illustrator and Acrobat Pro, R and R Studio, TNT, Endnote, multiple collection databases. Expert use of development resources such as The Foundation Center, Guidestar, Hoover and Federal 990 form searchable databases.

Photomicroscopy, SEM, Ion microprobe, and CT scanning.

Fossil and amber preparation and casting techniques.

Insect, spider, and fossil field collection and curation.

Radiocarbon dating and isotopic analysis of Quaternary insect chitin.

REFERENCES

Available upon request.