BIOGRAPHICAL SKETCH

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NAME: Eric S. Loker

eRA COMMONS USER NAME (credential, e.g., agency login):

POSITION TITLE: Distinguished Professor Emeritus

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
Cornell University, Ithaca, NY	B.S.	1972	Biology
University Michigan, Ann Arbor, MI	M.S.	1974	Zoology
Iowa State University, Ames, IA	Ph.D.	1979	Immunology
Oregon State University, Corvallis, Oregon	Postdoctoral	1979-1983	Immunology (Zoology)

A. Personal Statement

I have a long-standing interest in the biology of infectious organisms and their interactions with their invertebrate vectors. More specifically, my studies have mostly focused on animal parasites known as schistosomes that are responsible for causing one of the world's most prevalent and recalcitrant Neglected Tropical Diseases (or NTDs), schistosomiasis. This disease afflicts more than 200 people mostly in sub-Saharan Africa. Schistosomes have the distinctive attribute of being vectored by particular species of freshwater snails. I have pursued studies of schistosome-snail interactions and schistosomiasis in the field, first in Tanzania and over the last 30 years, in Kenya. My interests in schistosome biology have also taken me to Brazil, the Caribbean region, Egypt, Sri Lanka and Nepal. The collaboration that has been most enduring is with the Kenya Medical Research Institute (KEMRI) in Nairobi. We have collaborated on studies as diverse as: surveying the distribution of freshwater snails in Kenya; exploring the phylogenetic relationships of schistosomes and schistosome-transmitting snail in both Kenya and globally; undertaking molecular epidemiological studies of schistosome transmission in Kenya including the impact of control programs and presence of schistosome isolates less responsive to praziquantel; investigating the impact of natural enemies such as crayfish and amphistome flukes on schistosome transmission; and we have enrolled and treated Kenyan schoolchildren as part of our studies. Along with Dr. Gerald Mkoji and others at KEMRI I have provided much-needed graduate level training in medical malacology and field schistosomiasis work for both Kenyan and U.S. students, and we have worked to provide needed research infrastructure development for KEMRI. Although I have moved to emeritus status, I retain a position as Curator of the Parasite Division at the Museum of Southwestern Biology within the UNM Biology Department and all my UNM lab facilities in fully functional form. Our work is supported by my NIH R37 Merit Award, the second 5 year allotment of funded scheduled to begin in May, 2022.

In addition to our longstanding field-oriented work in Africa, we have worked to further characterize the biology of schistosomes, including species that occur here in the U.S. southwest. One of our recent studies (see reference below) identified a transmission focus for a highly pathogenic schistosome of dogs in Moab, Utah, thereby documenting a continuing pattern of spread of this species into more northerly locations. Below, I also touch on some of my work done at UNM over the years to help build our scientific visibility and infrastructure, as a Biology chair and as founding director of the Center for Evolutionary and Theoretical Immunology (CETI) funded for all 3 allowable funding cycles through the NIH-IDeA Centers for Biomedical Research Excellence (COBRE) program. I also currently serve as Curator of the Division of Parasites of the Museum of Southwestern Biology. I am motivated to grow this collection and to use it to address important questions related to diversity of infectious organisms, emergence of zoonotic pathogens, and global warming, particularly as it related to eukaryotic parasites.

B. Positions, Scientific Appointments and Honors

Positions and Scientific Appointments

Distinguished Professor Emeritus, Department of Biology, University of New Mexico, 2020-present (0.25 FTE, renumeration)
Distinguished Professor, Department of Biology, University of New Mexico, August, 2012 –2019 (1.0 FTE, renumeration)
Curator, Division of Parasitology, Museum of Southwestern Biology, 2010-present
Director, NIH COBRE Center for Evolutionary and Theoretical Immunology, 2003-2019
Chairman, Department of Biology, University of New Mexico, 2003-2009 (1.0 FTE, renumeration)
Regents' Professor, Department of Biology, University of New Mexico, 2003-2012 (1.0 FTE, renumeration)
Professor, Department of Biology, University of New Mexico, 1996-2012 (1.0 FTE, renumeration)
Associate Chair, Department of Biology, University of New Mexico, 1991-92, 95-97
Regent's Lecturer, University of New Mexico, 1994-1997
Associate Professor, Department of Biology, The University of New Mexico, 1990 -1996 (1.0 FTE, renumeration)
Assistant Professor, Department of Biology, The University of New Mexico, 1985-1990 (1.0 FTE, renumeration)
Assistant Professor, Department of Biology. Virginia Commonwealth University, 1983-85 (1.0 FTE, renumeration)
Postdoctoral Research Associate, Department of Zoology, Oregon State University, 1982-1983 (1.0 FTE, renumeration)
Instructor, Department of Zoology, Oregon State University, 1979-1982 (1.0 FTE, renumeration)
Lecturer, Department of Zoology, Iowa State University, 1978 (0.25 FTE, renumeration)
Graduate Teaching Assistant, Department of Zoology, Iowa State University, 1974-78 (0.5 FTE, renumeration)
Graduate Teaching Assistant, Department of Zoology, University of Michigan, 1972-1974 (0.5 FTE, renumeration)

Honors

Fulbright Scholarship, Tanzania, 1978-1979
Fogarty Senior International Fellow, University of Glasgow, Jan-July 1992
AD Hoc Member, NIH Tropical Medicine and Parasitology Study Sections, 1990, 1992, 1993, 1995, 1997, 2002, 2003, 2006, 2008, 2012
Member, NIH study section on Tropical Medicine Research Centers, 1995, 2000, 2001, 2011
Chairman, NIH Special Emphasis Panel, Schistosomiasis Reagent Resource Center Proposal, 2002
NIH Study Section, IDeA Program, 2010, 2011, 2014, 2020
NIH Postdoctoral F32 Review, 2015
NIH U.S China Collaborative Program Review, 2016
Member, Editorial Board, *Journal of Helminthology*, 2004-; *Journal of Invertebrate Pathology 1990-1993*, *Journal of Parasitology* 1993-97
Temporary Advisor, World Health Organization Scientific Working Group on Schistosomiasis, 2005
Participant, Gates Foundation SCORE (Schistosomiasis Consortium for Operational Research and Evaluation) program, 2010-present
President (elected, 2012-2013), American Society of Parasitologists, 2013
Clark P. Read Mentoring Award, American Society of Parasitologists, 2015
NIH Merit Award 2017
Temporary Advisor to WHO's team for development of new guidelines for control of schistosomiasis, 2019-2020.

C. Contributions to Science

1. **Global Diversity of Schistosome Parasites:** A long-term goal of my research has been to use molecular phylogenetics methods applied to samples of schistosomes that have been collected by myself and colleagues over a span of many years on all continents except Antarctica, to define the full diversity inherent in the trematode family Schistosomatidae. This group of parasites is of considerable veterinary and medical significance (>240 million people are still infected with the great neglected disease of schistosomiasis). We have provided new insights to define the limits of the family, and new hypotheses for how medically important species of *Schistosoma* are related to one another, including new scenarios for their origin. We have also identified many new lineages of avian schistosomes that are responsible for causing cercarial dermatitis

around the world, and worked to develop new ways to detect them in water samples, including primers now being used by others.

Devkota, R., Brant, S.V., Loker, E.S. 2015. The *Schistosoma indicum* species group in Nepal: presence of a new lineage of schistosome and use of the *Indoplanorbis exustus* species complex of snail hosts. Int. J. Parasitol. doi: http://dx.doi.org/10.1016/j.ijpara.2015.07.008. PMID: 26385438 PMCID: PMC4651714

Jothikumar N, Mull BJ, Brant SV, Loker ES, Collinson J, Secor WE, Hill VR. 2015. Real-time PCR and sequencing assays for rapid detection and identification of avian schistosomes in environmental samples. Appl Environ Microbiol 81:4207–4215. doi:10.1128/AEM.00750-15 PMID: 25862226 PMCID: PMC4524150

Brant Sara V., Loker, Eric S., Casalins, L., and Flores, V. 2017. Phylogenetic placement of a schistosome from an unusual marine snail host, the false limpet (*Siphonaria* lessoni) and gulls (*Larus dominicanus*) from Argentina with a brief review of marine schistosomes from snails. Journal of Parasitology 103: 75-82. PMID: 27611734

Colley, D.G. and Loker, E.S. 2018. Editorial. New tools for old questions: how strictly human are “human schistosomes” – and does it matter? The Journal of Infectious Diseases, jiy030, https://doi.org/10.1093/infdis/jiy030 PMID: 29365121

Eric S. Loker, Scott Z. Dolginow, Suzanne Pape, Colin D. Topper, Pilar Alda, Jean P. Pointier, Erika T. Ebbs, Melissa C. Sanchez, Guilherme G. Verocai, Randall J. DeJong, Sara V. Brant and Martina R. Laidemitt. 2021. An outbreak of canine schistosomiasis in Utah: Acquisition of a new snail host (*Galba humilis*) by *Heterobilharzia americana*, a pathogenic parasite on the move. One Health 13,100280,ISSN 2352-7714, https://doi.org/10.1016/j.onehlt.2021.100280.

2. Control of Human Schistosomiasis: The WHO has called for the elimination of human schistosomiasis as a public health problem where possible by 2030, and my lab is working to develop innovative new approaches for controlling the snails that are essential to transmission of this neglected tropical disease. We have explored the use of competitor snails, snail predators like crayfish, other trematode species that compete with and consume larval schistosomes in snails, and most recently, have been working to discover new snail pathogens like nematodes and viruses. Our hope is to provide useful ways to complement chemotherapy to assist in the global elimination effort.

Zhang, Si-Ming, Lijing Bu, Martina Laidemitt, Lijun Lu, Martin Mutuku, Gerald Mkoji, and Eric S. Loker. 2018. Complete mitochondrial and rDNA complex sequences of important vector species of *Biomphalaria*, obligatory hosts of the human-infecting blood fluke, *Schistosoma mansoni*. Scientific Reports. 8:7341. DOI:10. 10.1038/s41598-018-25463-z. PMC6461134

Mutuku, M.W., Laidemitt, M.R., Beechler, B.R., Mwangi, I.N., Otiato, F.O., Agola, E.L., Ochanda, H., Kamel, B., Mkoji, G.M., Steinauer, M.L., Loker, E.S., 2019. A search for snail-related answers to explain differences in response of *Schistosoma mansoni* to praziquantel treatment among responding and persistent hotspot villages along the Kenyan shore of Lake Victoria. Am J Trop Med Hyg 101, 65-77. PMC6609173

Laidemitt, M.R., Anderson, L.C., Wearing, H.J., Mutuku, M.W., Mkoji, G.M., Loker, E.S., 2019. Antagonism between parasites within snail hosts impacts the transmission of human schistosomiasis. eLife 2019;8:e50095 DOI: 10.7554/eLife.50095 PMC6917487

Laidemitt, M.R., Sarah K Buddenborg, Lowell L. Lewis, Lionel E. Michael, Maria Jesus Sanchez Martin, Reynold Hewitt and Eric S Loker. 2020. *Schistosoma mansoni* vector snails in Antigua and Montserrat, with snail-related considerations pertinent to a declaration of elimination of human schistosomiasis. American Journal of Tropical Medicine and Hygiene. doi:10.4269/ajtmh.20-0588. PMC7695099

Kamel, B., Lu, Lijun, Laidemitt M, Babbitt C, Weinbaum OL, Mkoji G and Loker ES. 2021. Detecting and identifying *Schistosoma* infections in snails and aquatic habitats: a review. Prepared at request and with support of the World Health Organization. PLos NTD: https://doi.org/10.1371/journal.pntd.0009175

3. Invertebrate (Molluscan) Immune Systems: Beginning with observations that I first made and that were followed up in collaboration with colleagues who were supported by my grants, we identified a group of snail immune molecules called FREPs comprised of immunoglobulin and fibrinogen domains that are a major component of the response of snails to infection with schistosomes and other trematodes. This leads to further studies showing FREPs were diversified somatically by gene conversion and point mutations. Knockdown of FREPS was also shown to abrogate resistance of snails to schistosome infections. This line of work lead to a paradigm shift of sorts, a greater realization that invertebrate immune responses were more complex than previously envisioned and capable of generating diverse receptors. It highlighted that different invertebrate

lineages have very different immune capacities, and also lead to important ideas that immune system diversification in response to distinct groups of parasites is a factor that contributes to the overall diversity of animal life.

Zhang, S.M., Adema, C.M., Kepler, T.B. and Loker, E.S. 2004. Diversification of Ig superfamily genes in an invertebrate. Science 305: 251-254. PMID: 15247481

Buddenborg SK, Kamel B, Hanelt B, Bu L, Zhang S-M, Mkoji GM, and Loker, E.S. 2019. The in vivo transcriptome of *Schistosoma mansoni* in the prominent vector species *Biomphalaria pfeifferi* with supporting observations from *Biomphalaria glabrata*. PLoS Negl Trop Dis 13(9): e0007013. https://doi.org/10.1371/journal.pntd.0007013. PMC6797213

Lu, L., Loker, E.S., Zhang, S-M., Buddenborg, S.K. and Bu, Lijing. 2020. Genome-wide discovery, and computational and transcriptional characterization of an AIG gene family in the freshwater snail *Biomphalaria glabrata*, a vector for *Schistosoma mansoni*. BMC Genomics (2020) 21:190 https://doi.org/10.1186/s12864-020-6534-z

Lu, Lijun, Loker, E.S., Adema, C., Zhang, Si-Ming, and Bu, Lijing Bu. 2020. Genomic and transcriptional analysis of genes containing fibrinogen and IgSF domains in the schistosome vector *Biomphalaria glabrata*, with emphasis on the differential responses of snails susceptible or resistant to *Schistosoma mansoni.* PLoS NTD, 10(4): e0008780.

4. Building Scientific Infrastructure in New Mexico: New Mexico has traditionally been underfunded with respect to both NSF and especially NIH funding. Through the NIH IDeA program, I served as the PI and founding director for an NIH Centers of Biomedical Research Excellence grant to fund the Center for Evolutionary and Theoretical Immunology for 15 years. Our center made several faculty hires to increase our critical mass, supports junior investigators by providing mentoring and aiding grant submission, and has developed and supported key core facilities for molecular and cell biology work that are widely used by the UNM community. The IDeA program has provided an outstanding opportunity for New Mexico investigators to become more competitive in research, and I am proud to have played a role in this important program. I am also aware, more than ever, of the importance of natural history collections, and doing what I can to oversee the growth of the Division of Parasites as part of the Museum of Southwestern Biology and apply this collection to relevant biological issues of the day.

5. Supporting Education Pertaining to Parasitology: I mark as one of my contributions to science the development of curricula and teaching materials for the biology of infectious organisms and parasitology, including the following textbook:

Loker, E.S. and Hofkin, B.V. 2015. Parasitology: a conceptual approach. Garland Press. 560p.

(second edition now written and scheduled for publication in 2022)

Complete List of Published Work:

http://www.ncbi.nlm.nih.gov/myncbi/browse/collection/48309224/?sort=date&direction=descending

Additional Information: Research Support

Current Support

R37 AI101438 (Loker) 07/01/2017 – 06/30/2022
NIH/NIAID Snail-Related Studies of Transmission and Control of Schistosomiasis in Kenya.

The goals of this continuation grant are 1) To reveal and dissect the roles of different *Biomphalaria* taxa with marked biological differences in the transmission of *Schistosoma mansoni* in six representative transmission sites in the Lake Victoria basin; 2) To define and exploit the biodiversity of non-schistosome digeneans in the Lake Victoria basin, to compete with and suppress *S. mansoni* infections within *Biomphalaria*; and 3) To develop novel approaches for snail or larval schistosome control.

Note: the second five-year allotment of the funding is set to begin in May, 2022.