

CURRICULUM VITAE

Shannon N. Bennett

Associate Curator of Microbiology
Patterson Scholar chair
California Academy of Sciences
Golden Gate Park
55 Music Concourse Dr., San Francisco, CA 94118

Phone: 415-379-5334
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Email: sbennett@calacademy.org
Nationality: Canadian (US Permanent Resident)
Marital Status: married, 1 child

Research Interests The evolutionary ecology of microbes and emerging infectious diseases, particularly the forces that shape diversity in fast-evolving RNA viruses under different epidemiological and ecological conditions, transmission dynamics and life history modes.

Education **PhD, Zoology.** University of British Columbia, Vancouver, BC, Canada. Nov. 1999; *Dissertation*: “Host distribution and development of *Pseudodelphis oligocotti* (Nematoda: Dracunculoidea), a parasite of eelgrass bed fishes.”

Supervisor: Dr. M. L. Adamson

BSc, Biology. McGill University, Montreal, Quebec, Canada. Oct. 1991

Research Experience **2011 – present, Associate Curator**, Associate Curator of Microbiology, California Academy of Sciences, San Francisco, CA

2011, Adjunct Associate Professor, Asia-Pacific Institute of Tropical Medicine and Infectious Diseases, Department of Tropical Medicine, Medical Microbiology and Pharmacology, John A. Burns School of Medicine, University of Hawaii, Honolulu, HI

2004 – 2011, Assistant Professor, Asia-Pacific Institute of Tropical Medicine and Infectious Diseases, Department of Tropical Medicine, Medical Microbiology and Pharmacology, John A. Burns School of Medicine, University of Hawaii, Honolulu, HI

2000 – 2004, Postdoctoral Researcher, University of Puerto Rico – Rio Piedras, PR; “Molecular epidemiology and evolution of dengue in Puerto Rico.”

2000, Postdoctoral Researcher, University of Texas at Austin, TX
“Phylogenetic determinants of host specificity of parasitic nematode *Pseudodelphis oligocotti*.”

1994 – 1999, Postgraduate Researcher, Dissertation, University of British Columbia, BC; “Life cycle, ecology, and host specificity of parasitic nematode *Pseudodelphis oligocotti* in coastal marine fishes.”

1991 – 1993, Postgraduate Researcher, University of British Columbia, BC; “Impact of parasites on the population dynamics of sockeye smolts,” with Dr. L. Margolis, Dept. of Fisheries and Oceans, Pacific Biological Station, Nanaimo, BC

1990, Research Assistant, Dept. Fisheries & Oceans, Institut Maurice-Lamontagne, PQ; “Stock identification and distribution of Atlantic herring.”

Publications Thongsripong P., Chandler, J.A., Green A., Kittayapong P., Wilcox B.A., Kapan D.D., **Bennett S.N.** Vector-associated bacterial and eukaryotic microbial communities across habitat types in Thailand. In prep for BMC Microbiology.

Chandler, J.A., Lui, R., **Bennett, S.N.** 2015. RNA shotgun metagenomic sequencing of northern California (USA) mosquitoes uncovers viruses, bacteria, and fungi. *Frontiers in Microbiology*. *In press*.

Bennett, S.N., Gu, S.H., Kang, H.J., Arai, S., Yanagihara, R. 2014. Reconstructing the evolutionary origins and phylogeography of hantaviruses. *Trends in Microbiology* Vol. 22, Issue 8, p473–482.

Chandler, J.A., Thongsripong, P., Green, A., Kittayapong, P., Wilcox, B.A., Schroth, G.P., Kapan, D.D., **Bennett, S.N.** Metagenomic shotgun sequencing of a Bunyavirus in wild-caught *Aedes aegypti* from Thailand informs the evolutionary and genomic history of the Phleboviruses. *Virology* 464, 312–319.

Martin, E., Chirivella, M., Co, J.K.G., Santiago, G.A., Gubler, D.J., Munoz-Jordan, J., **Bennett, S.N.** New Insights into the Molecular Evolution of Dengue Virus Type 4 in Puerto Rico over two Decades of Emergence. *Virus Research, in revision.*

Nelson-Hurwitz, D.C., Katz, A.R., Whelen, A.C., Lu, Y., **Bennett, S.N.** The Role of Hawai'i in Influenza Transmission Patterns. *Emerging Infectious Diseases, in revision.*

Nelson-Hurwitz, D.C., Whelen, A.C., Katz, A.R., Lu, Y., **Bennett, S.N.** Molecular Epidemiology of the 2009 Pandemic H1N1 Influenza in Hawai'i. *Journal of General Virology, in revision.*

Bennett, S.N. 2014. Taxonomy and Evolutionary Relationships of Flaviviruses. In *Dengue and Dengue Hemorrhagic Fever*, 2nd edition. Eds. Gubler, D.J., Ooi, E.E., Vasudevan, S., Farrar, J. CAB International, Boston, MA, pp. 322-333.

Thongsripong P., Green A., Kittayapong P., Kapan D.D., Wilcox B.A., **Bennett S.N.** 2013. Mosquito vector diversity across habitats in central Thailand endemic for dengue and other arthropod-borne diseases. *PLoS Neglected Tropical Diseases*, 7(10), e2507. doi:10.1371/journal.pntd.0002507.

Ritchie S.A., Pyke A.T., Hall-Mendelin S., Day A., Mores C.N., Christofferson, R.C., Gubler, D.J., **Bennett, S.N.**, van den Hurk, A.F. 2013. An Explosive Epidemic of DENV-3 in Cairns, Australia. *PLoS ONE* 8(7): e68137. doi:10.1371/journal.pone.0068137

Arai S., Gu S. H., Baek L. J., Tabara K., **Bennett S. N.**, Oh H. S., Takada N., Kang H. J., Tanaka-Taya K., Morikawa S., Okabe N., Yanagihara R., Song J.W. 2012. Divergent ancestral lineages of newfound hantaviruses harbored by phylogenetically related crocidurine shrew species in Korea. *Virology*. 424(2):99-105. Epub. PMID: 22230701 NIHMS348716 PMCID: PMC3288197

Allicock, O.M., Lemey, L., Tatum, A.J., Pybus, O.G., **Bennett, S.N.**, Mueller, B.A., Suchard, M.A., Foster, J.E., Rambaut, A., Carrington, C.V.F. 2012. Phylogeography and Population dynamics of Dengue viruses in the Americas. *Mol Biol Evol.* 2012 Jun;29(6):1533-43. Epub 2012 Jan 6. PMID: 22319149, PMCID PMC3529620

Kang, H. J., **Bennett, S. N.**, Hope, A. G., Cook, J. A., Yanagihara, R. 2011. Shared Ancestry between a Newfound Mole-Borne Hantavirus and Hantaviruses Harbored by Cricetid Rodents. *Journal of Virology* 85(15):7496-7503. PMID: 21632770 PMCID3147906

Vanwambeke, S. O., **Bennett, S. N.**, Kapan, D. D. 2011. Spatially disaggregated disease transmission risk: land cover, land use and risk of dengue transmission on the island of Oahu. *Tropical Medicine and International Health* 16(2):174-85. PMID: 21073638 PMCID3049840

Bennett, S.N., Drummond, A. J., Kapan, D. D., Suchard, M. A., Munoz-Jordan, J. L., Pybus, O. G., Holmes, E. C., Gubler, D. J. 2010. Epidemic dynamics revealed in dengue sequence evolution. *Mol Biol Evol.* 27:811-818 PMID: 19965886 PMCID2877535

Steel, A., Gubler, D. J., **Bennett, S.N.** 2010. Natural Attenuation of Dengue Type-2 After a Series of Island Outbreaks: a retrospective phylogenetic study of events in the South Pacific three decades ago. *Virology* 405(2):505-512. PMID: 20663532 PMCID3150181

Imrie, A., Roche, C., Zhao, Z., **Bennett, S. N.**, Laille, M., Effler, P., Cao-Lormeau, V.-M. 2010. Homology of dengue virus type 1 complete genome sequences from dengue fever- and dengue hemorrhagic fever-associated epidemics in Hawaii and French Polynesia. *Annals of Trop Med and Parasitology*, 104(3):225-35. PMID: 20507696 PMCID3084289

Bennett, S. N. 2010. Evolutionary Dynamics of Dengue Virus. *In* *Frontiers in Dengue Virus Research*, eds. K. A. Hanley and S.C. Weaver. p. 157-172.

Kang, H. J., **Bennett, S. N.**, Sumibcay, L., Arai, S., Hope, A. G., Mocz, G., Song, J.-W., Cook, J. A., and Yanagihara, R. 2009. Evolutionary Insights from a Genetically Divergent Hantavirus Harbored by the European Common Mole (*Talpa europaea*). *PLoS ONE* 4(7):e6149. PMID: 19582155 PMCID2702001

Kang, H. J., **Bennett, S. N.**, Dizney, L., Sumibcay, L., Arai, S., Ruedas, L. A., Song, J.-W., and Yanagihara, R. 2009. Host switch during evolution of a genetically distinct hantavirus in the American shrew mole (*Neurotrichus gibbsii*). *Virology* 388:8-14. PMID: 19394994 PMCID2692302

Song, J.-W., Kang, H. J., Gu, S.-H., Moon, S. S., Song, K.-J., Baek, L. J., **Bennett, S. N.**, Kim, H.-C., O'Guinn, M. L., Lee, H.-C., Klien, T. A., and Yanagihara, R. 2009. Characterization of Imjin virus, a newly isolated hantavirus from the Ussuri white-toothed shrew (*Crocidura lasiura*). *J. Virology* 83(12):6184-91. PMID: 19357167 PMC2687366

Arai, S., **Bennett, S. N.**, Sumibcay, L., Cook, J. A., Song, J.-W., Hope, A., Parmenter, C., Nerurkar, V. R., Yates, T. L., and Yanagihara, R. 2008. Phylogenetically Distinct Hantaviruses in the Masked Shrew (*Sorex cinereus*) and Dusky Shrew (*Sorex monticolus*) in the United States. *American Journal of Tropical Medicine and Hygiene* 78:348 - 351. PMID: 18256444 PMC2262799

Song, J.-W., Gu, S. H., **Bennett, S. N.**, Arai, S., Puorger, M., Hilbe, M. and Yanagihara, R. 2007. Seewis virus, a genetically distinct hantavirus in the Eurasian common shrew (*Sorex araneus*). *Virology Journal* 4:114. PMID: 17967200 PMC2186316

Song, J.-W., Kang, H. J., Song, K.-J., Truong, T. T., **Bennett, S. N.**, Arai, S., Truong, N. U., and Yanagihara, R. 2007. Newfound Hantavirus in Chinese Mole Shrew, Vietnam. *Emerging Infectious Diseases* 13(11):1784-1787. PMID: 18217572 PMC2262106

Arai, S., Song, J.-W., Sumibcay, L., **Bennett, S. N.**, Nerurkar, V. R., Parmenter, C., Cook, J. A., Yates, T. L., and Yanagihara, R. 2007. Hantavirus in Northern Short-Tailed Shrew, United States. *Emerging Infectious Diseases* 13(9):1420-1423. PMID: 18252128 PMC2262104

Kapan, D. D., **Bennett, S. N.**, Ellis, B., Fox, J., Lewis, N., Spencer, J. H, Saksena, S., and Wilcox, B. A. 2006. Avian Influenza (H5N1) and the Evolutionary and Social Ecology of Infectious Disease Emergence. *EcoHealth* 3:187-194.

Odgerel, Z., Choi, I. K., Byun, K. S., Pak, C. Y., **Bennett, S. N.**, Gu, S.-H., Kee, K. H., Song, K.-J., and Song, J.-W. 2006. Complete Genome Sequence and Phylogenetic Analysis of Hepatitis B Virus (HBV) Isolated from Mongolian Patients with HBV infection. *Virus Genes* 33(3):345-349. PMID: 16991006

Imrie, A., Zhao, Z., **Bennett, S. N.**, Isami, F., Kitsutani, P., Laille, M., and Effler, P. 2006. Molecular epidemiology of dengue in the Pacific: introduction of two distinct strains of dengue virus type-1 [corrected] into Hawaii. *Annals of Trop Med and Parasitology* 100(4):327-36. PMID: 16762113

Bennett, S. N., Holmes, E. C., Chirivella, M., Rodriguez, D. M., Beltran, M., Vorndam, V., Gubler, D., and McMillan, W. O. 2006. Molecular evolution of dengue 2 virus in Puerto Rico: positive selection in the viral envelope accompanies clade reintroduction. *J. Gen. Virology* 87(Pt 4):885-93. PMID: 16528038

Cook, S., **Bennett, S. N.**, Holmes, E. C., De Chesse, R., Moureau, G., De Lamballerie, X. 2006. Isolation of a new strain of the Flavivirus, Cell Fusing Agent virus (CFAV), in a natural mosquito population from Puerto Rico. *J. Gen. Virology* 87:735-748. PMID: 16528021

Spiegel, J., **Bennett, S.**, Hattersley, L., Hayden, M. H., Kittayapong, P., Nalim, S., Wang, D. N. C., Zielinski-Gutierrez, E., and Gubler, D. 2005. Barriers and Bridges to Prevention and Control of Dengue: The Need for a Social-Ecological Approach. *EcoHealth* 2(4), 273-290.

Carrington, C. V. F., Foster, J. E., Pybus, O. G., **Bennett, S. N.** and Holmes, E. C. 2005. The invasion and maintenance of Dengue virus type 2 (subtype III) and type 4 in the Americas, *J. Virology* 79(23):14680-14687 PMID: 16282468 PMC1287558

Tonry, J. H., Brown, C. B., Cropp, C. B., Co, J. K. G., **Bennett, S. N.**, Nerurkar, V. R., Kuberski, T. and Gubler, D. J. 2005. West Nile Virus Detection in Urine. *EID* 11(8):1294-1296. PMID: 16102323

Bennett, S. N. and Adamson, M. L. 2004. Host Range of Eelgrass Bed Fish Parasite *Pseudodelphis oligocotti* (Nematoda: Dracunculoidea). *J. Parasitology* 90(4):678-684. PMID: 15357052

Foster, J. E., **Bennett, S. N.**, Carrington, C. V. F, Vaughan, H., and McMillan, W. O. 2004. Phylogeography and molecular evolution of Dengue 2 in the Caribbean Basin, 1981-2000. *Virology* 324(1):48-59. PMID: 15183052

Bennett, S. N., Holmes, E. C., Chirivella, M., Rodriguez, D. M., Beltran, M., Vorndam, V., Gubler, D., and McMillan, W. O. 2003. Selection-driven evolution of emergent dengue virus. *Molecular Biology and Evolution* **20**(10): 1650-1658. PMID: 12832629

Foster, J. E., **Bennett, S. N.** [First 2 authors contributed equally] Vaughan, H., Vorndam, V., McMillan, W. O., and Carrington, C. V. F. 2003. Molecular evolution and phylogeny of Dengue Type 4 virus in the Caribbean. *Virology* **306**:126-134. PMID: 12620805

Bennett, S. N., Adamson, M. L., and Margolis, L. 1998. Long-term changes in parasites of sockeye salmon (*Oncorhynchus nerka*) smolts. *Canadian Journal of Fisheries and Aquatic Sciences* **55**(4): 977-986.

- Teaching** **2013**, SFSU Disease Ecology course lecture: Dengue Evolutionary Ecology
- 2013**, Children's Hospital Oakland Research Institute graduate seminar class, Dengue virus evolution and epidemic activity
- 2013**, California Academy of Sciences Summer Systematics Institute, The Evolutionary Dynamics of Microbes
- 2013**, Workshop on Phylogenetics and Bioinformatics, University of Puerto Rico.
- 2013**, Introduction to Microbes and Evolution, Mosquito and Vector Control Association of California
- 2012**, California Academy of Sciences Careers in Science, "Evolution and Ecology of Infectious Diseases
- 2010**, Invited Lecture, "Molecular Epidemiology of Dengue" in PH666, Seminar in Infectious Disease Control, Dept. of Public Health, University of Hawaii
- 2010**, Invited Lecture, "Bioinformatics & Emerging Infectious Disease: How molecular data inform us about the epidemiology, ecology and evolution of infectious diseases" in PH664, Dept. of Public Health, University of Hawaii
- ***2008, 2007, 2006, 2005** TRMD 653 Graduate Course. Bioinformatics in Infectious Diseases, Dept. of Tropical Medicine, University of Hawaii
- ***2009, 2008, 2007, 2006** Team Faculty IGERT core course IS 650/651/652 Applied Evolutionary Ecology, Dept. of Interdisciplinary Studies, University of Hawaii
- 2008** Team Faculty TRMD 705 Major Concepts in Infectious Disease: Molecular Evolution of Infectious Disease, Dept. of Tropical Medicine, University of Hawaii
- 2008** (March 17), Invited Lecture, "Sequence Evolution and Phylogenetics of Avian Influenza Emergence" in PH792E, Dept. of Public Health, University of Hawaii
- 2007** (Nov 26), Invited Lecture, "Phylogenetics and the evolution of sequences in disease emergence" in PHS788 Seminars in Public Health, Dept. of Public Health, University of Hawaii
- 2010, 2009, 2007**, Team Faculty "Analysis of Sequence Evolution in Dengue" in CMB 621 Graduate Course, Dept. of Cell and Molecular Biology, University of Hawaii
- 2007 (February)**, Invited Lecture, "Evolution in Avian Influenza" in TRMD 515 Seminar course for Medical Students, J A Burns School of Medicine, University of Hawaii
- ***2006** TRMD 650 Graduate Course. Advanced Epidemiology and Ecology of Infectious Diseases, Dept. of Tropical Medicine, University of Hawaii
- 2006** Invited Lecture, "The Evolutionary and Social Ecology of Avian Influenza, H5N1, emergence" PHS788 Seminars in Public Health, Dept. of Public Health, University of Hawaii
- 2006** Invited Lecture, "Viral Pathogenesis and Comparative Genomics" in TRMD 604 Infectious Disease Microbiology I, Dept. of Tropical Medicine, University of Hawaii

2006 Invited Lecture, “Dengue Emergence and Molecular Evolution” in PHS 696 Public Health Lecture Series, Dept. of Public Health, University of Hawaii

2005 Invited Lecture, “Dengue Virus Infection, Neurologic Manifestations” in TRMD 607 Advances in Neurovirology, Dept. of Tropical Medicine, University of Hawaii

***2002** Graduate Seminar/Workshop, Phylogenetics and Molecular Evolutionary Analysis, University of Puerto Rico

2000 Instructor, Ecology, Evolution, and Society, University of Texas at Austin

1999 Instructor, Ecology and Evolutionary Biology, University of Texas at Austin

1998, '97, '96 Instructor of Introductory Parasitology (3rd year undergraduate course for majors), University of British Columbia (U. B. C.)

1998 Assistant instructor of Biology (1st year undergraduate course) under Prof. Paul Harrison, Department of Zoology, U. B. C.

***1997** Assistant instructor of Ecological Parasitology (4th year undergraduate course for majors) under Dr. Stephen Connor, Dept. Zoology, U. B. C. Designed entire laboratory and field component.

1996 Assistant instructor of Evolutionary Ecology (4th year undergraduate course for majors) under Prof. Dolph Schluter, Dept. Zoology, U. B. C.

1995 Assistant instructor of Biological Statistics (3rd year undergraduate course for majors) with Prof. Eric Taylor, Dept. Zoology, U. B. C.

1993 Supervisor/instructor of two undergraduate honors students on project: population dynamics of sockeye salmon and their parasites, with Prof. Martin L. Adamson, Dept. Zoology, U. B. C.

1992 Assistant instructor of Introductory Parasitology (3rd year undergraduate course for majors) with Prof. Martin L. Adamson, Dept. Zoology, U. B. C.

1991-1992 Assistant instructor of Biological Statistics (3rd year undergraduate course for majors) with Prof. Dolph Schluter, Dept. Zoology, U. B. C.

Grants & Awards

ACTIVE

CAS Research Excellence Award: Habitat degradation, biodiversity loss, and infectious diseases in mosquito communities along a latitudinal gradient (Bennett) 07/01/2014 – 06/30/2015
Role: PI \$6,959

CAS Research Excellence Award: Removal of host ribosomal RNA for improved characterization of the mosquito microbiota (Chandler) 07/01/2014 – 06/30/2015
Role: co-PI \$6,282

MRI: Acquisition of a Next-Generation Sequencer for a Shared Genomics Core Facility at San Francisco State University and the California Academy of Sciences

(de la Torre) 9/1/2014 – 8/31/2017

NSF (DBI - MAJOR RESEARCH INSTRUMENTATION) \$514,263

Role: Senior Personnel

PENDING

Preliminary Proposal: Uncovering the biodiversity of mosquitoes and their microbes (Bennett) 1/1/2016 - 12/31/2019

NSF (DEB) NA

Objective is to characterize mosquito biodiversity and that of their microbes across a latitudinal gradient of habitat degradation and develop a model for the relationships between diversity, ecological complexity and risk of disease emergence.

Role: PI

R01 (LaBeaud/Bennett) Host and Viral Determinants of Severe and Chronic Chikungunya Disease in Grenada 7/1/2015 – 6/30/2020

NIH/NIAID \$500,000 annual direct

Role: multi-PI

Novel Flaviviruses in Dengue Vectors

(Bonizzoni)

9/1/2014 – 8/31/2016

NIH/NIAID

\$67,194

Objective is to discover and characterize the diversity and phylogeography of insect-specific flaviviruses, which lie at the root of all known pathogenic flaviviruses in humans, in mosquito species *Aedes aegypti* and *Ae. albopictus*, important vectors of dengue and other viral pathogens.

Role: subcontract PI

P01 Immune Correlates of Dengue Protection and Pathogenesis

submitted 05/2014

(Harris)

NIH

Objective is to determine the immune responses to dengue viruses in first-time exposed versus previously exposed individuals, in comparison to vaccine recipients with no versus one or more previous exposures to dengue viruses. Immune responses will be characterized specifically with respect to clinical factors, pathogenesis, and virus genotype where possible.

Role: senior personnel

R01 Socio/Ecological Change and Emerging Dengue in a Tropical Rural Area: Virus, Vias and Bias

submitted 07/2014

(Eisenberg)

NIH/NIAID

Objective is to determine the factors driving dengue persistence, local extinction, and reintroduction in rural areas with variable exposure to urban population centers and dengue sources.

Role: co-PI

COMPLETEDRCE-PSW Project (**Bennett**)

5/01/2009 - 4/30/2014

U54 AI065359 (Barbour, Alan)

\$160,000 annual direct

NIH

Regional Center of Excellence for Biodefense and Emerging Infectious Diseases Research

Subproject: Genetic Signatures of Dengue Virus Emergence

Our objective is to determine the viral genetic basis of dengue emergence by comparing replicate populations undergoing phase shifts in dengue transmission, elucidating the genetic signature of epidemicity, determining the adaptive mechanisms and verifying substitutions in vitro and in vivo.

Role: subcontract PI

Integrative Graduate Education & Research Training

(IGERT) 0549514

(Kaneshiro)

8/1/2006 – 11/31/2013

NSF

\$2,877,643

Integrative Training in Ecology, Conservation and Pathogen Biology

Taking advantage of Hawaii's unique biota and similarly diverse research community, we integrate graduate research and training in ecology and evolution and disease through a wide range of research programs including coral reef disease ecology to the socio-ecological determinants of leptospirosis incidence and host specificity.

Role: co-PI, Assistant Director

U01 AI075385-01 (Felgner)

07/01/2008 – 06/30/2013

NIH/NIAID

\$60,000 (subcontract)

Multiplex Serodiagnostic Protein Microarray

We propose to design and field-test a microarray of immunodominant antigens for 56 category A and B pathogens, most of which overlap in distribution and cause similar febrile symptoms. This chip will be applied to diagnosing and directing treatment, and determining the actual distribution and tracking exposure to disease agents including dengue virus, hantavirus, influenza A & B, HIV, *Rickettsia* spp., *Leptospira interrogans*, *Plasmodium* spp., and *Mycobacterium tuberculosis*.

Role: Consortium co-PI

- 2 G12 RR003061-21 (Ostrander) 8/1/2006 – 7/31/2011
 NIH RCMI Program – Project (**Bennett**) \$100,000
 Research Outcomes Acceleration Discoveries for Medical Applications (ROADMAP)
 Subtitle: Molecular Evolutionary Pathogenesis of Dengue Virus Infection
 The goal of this project is to identify the molecular genetic correlates of dengue virus epidemic potential and population-level pathogenesis, to determine whether genetic evolution occurred by non-random selection or random drift, and to assess the phenotypic effects of these genetic mutations in experimental models.
 Role: Project Leader
- R01 AI075057-02 (Yanagihara) 08/08/2008-07/31/2012
 NIH/NIAID \$250,000
 Intraspecies Transmission and Infectivity of Insectivore-borne Hantaviruses
 The goal of this project is to describe the host distribution and infectivity of a new clade of sorcid-borne Hantaviruses starting with type specimen Imjin virus, recently discovered in Ussuri shrews in Korea, an area endemic for hemorrhagic fever with renal syndrome (HFRS) due to hantavirus infection
 Role: Bioinformatician
- P20 RR018727-06A1 COBRE (Yanagihara) 07/01/2010 – 06/30/2015
 NIH/NCRR \$2,175,515
 Pacific Center for Emerging Infectious Diseases Research
 The overall goal of this project is to develop research excellence for emerging infectious diseases, particularly vector-borne, for the State of Hawai'i at the University of Hawai'i at Manoa. The Center consists of a Technical Core, which provides support in biostatistics and bioinformatics.
 Role: Bioinformatician
- P20 RR016467-09A1 (Holmes, Eric) 2010 - 2013
 NIH/NCRR \$9,200,000
 INBRE II: Hawaii Statewide Research & Education Partnership (HSREP)
 Role: Expert Researcher in the Bioinformatics core, \$680,000.00
- RCE-PSW Project (**Bennett**) 5/1/2007 – 4/30/2009
 U54 AI065359 (Barbour, Alan) \$100,000
 NIH
 Regional Center of Excellence for Biodefense and Emerging Infectious Diseases Research
 Subproject: Factors Influencing the Epidemic Potential of Dengue Viruses
 The goal of this project is to employ phylogenetic analyses of viral coding gene sequence data of dengue isolates across endemic/epidemic cycles replicated in different populations, to determine the role of natural selection versus genetic drift in the sudden onset of virulence or epidemic potential.
 Role: Project Investigator
- P20 RR018727 (Yanagihara) 9/30/2003 - 6/30/2008
 NIH/NCRR \$1,392,255
 Pacific Center for Emerging Infectious Diseases Research
 The overall goal of this project is to establish a center of research excellence for emerging infectious diseases for the State of Hawai'i at the University of Hawai'i at Manoa. The Center consists of a Technical Core, which provides support in biostatistics and bioinformatics.
 Role: Bioinformatician
- RCE-PSW Career Development Award (**Bennett**) 5/22/2005 - 4/30/2007
 Under 1U54AI065359-01 (Barbour, Alan) \$559,649
 NIH
 Regional Center of Excellence for Biodefense and Emerging Infectious Diseases Research
 Subproject: Factors Influencing the Epidemic Potential of Dengue Viruses
 The goal of this project is to employ phylogenetic analyses of viral coding gene sequence data of dengue isolates across endemic/epidemic cycles replicated in different populations, to determine the role of natural selection versus genetic drift in the sudden onset of virulence or epidemic potential.
 Role: Consortium PI

IdeA Networks of Biomedical Research Excellence, State of Hawaii (Smith),
 Subaward (**Bennett**) 4/15/2005 - 7/31/2005
 Molecular Pathogenesis of Dengue Virus \$34,350
 The goal of this project was to develop long RT-PCR towards more efficient whole-genome sequencing of dengue viruses from Puerto Rico, ultimately to determine the molecular basis of changes in epidemiologic behavior over the last 25 years based on phylogenetic inference.
 Role: PI

R01 AI47497 McMillan (PI) 09/30/1999-10/01/2004
 NIH/NIAID \$841,937
 Molecular Epidemiology of Dengue in Puerto Rico
 This is a molecular phylogenetic study of dengue serotypes 2 and 4 isolated in Puerto Rico and surrounding regions since reintroductions in the late 1970s to early 1980s until present day, using sequence data from structural and nonstructural viral genes.
 Role: Post-doc/Research Associate (09/01/2000-08/31/2004).

Awards **2015** Recipient of the Patterson Scholar chair for Microbiology

2000 FastTex Course Improvement Award, University of Texas. \$7000

1998 Marc Dresden Travel Award to attend the 73rd annual meeting of the American Society of Parasitologists in Kona, Hawaii August 16-20, 1998. \$350

1996 Marc Dresden Travel Award to attend the 71st annual meeting of the American Society of Parasitologists in Tucson, Arizona June 11-15, 1996. \$350

1993-1995 Natural Sciences and Engineering Research Council PGS B for postgraduate studies. \$28,000 Cdn

1992-1995 Department of Fisheries and Oceans / Natural Sciences and Engineering Research Council Science Subvention Program grant to M. L. A. (coauthored by S.N.B.), University of British Columbia, for research support/stipend. \$30,000 Cdn

1990 Huntsman Marine Biology Research Station scholarship, McGill University, PQ. \$500 Cdn

Service: Reviewer Proceedings of the National Academy of Sciences (PNAS)

Trends in Microbiology

Transactions of the Royal Society, London, Series B

Infection, Genetics and Evolution

PLOS One

PLOS Pathogens

PLOS Neglected Tropical Diseases

Journal of Virology

Journal of Parasitology

Journal of General Virology

Molecular Phylogenetics and Evolution

Archives of Virology

EcoHealth

Mathematical Population Studies

BioMed Central

American Journal of Tropical Medicine and Hygiene

Journal of Virological Methods

Interdisciplinary Perspectives on Infectious Diseases

Diversity and Distributions

U.S. Dept. of Health and Human Services Biotechnology Engagement Program

NIH Challenge Grant 2009 Stage 1 Reviewer

Committees Search committee, Curator of Botany, 2013-14, California Academy of Sciences

Search committee, Grants Administrator, 2012, California Academy of Sciences

Search committee, Docent Program Director, 2012, California Academy of Sciences

Search committee, Assoc. Dean of Research, 2008, J. A. Burns School of Medicine, UH

Search committee, Biostatistician, 2008-09, Public Health Sciences, UH

Search committee, Biostatistician, 2006, Dept. of Tropical Medicine, UH

Curriculum development committee, 2006-11, NSF IGERT UH

Graduate admissions committee, 2006-09, Dept. of Tropical Medicine, UH

Curriculum committee, 2009-11, Dept. of Tropical Medicine, UH

Graduate examination committee, 2008-11, Dept. of Tropical Medicine, UH

Graduate Committees: Argon Steel, MS grad. (Chr), PhD candidate (Chair)

Sean Edgerton, MS candidate (Chair)

Amy Henry, PhD graduated (Chair)

Denise Nelson, MS grad. (Chr), PhD graduated (Chr)

Joseph Martin, MS cand. (Chair)

Panpim Thongsripong, MS graduated (Chair)

Brandi Mueller, MS graduated (Chair)

Theresa Kurisu, MS graduated

Maite Aubry, PhD graduated (Université de la Polynésie Française)

Selene Garcia-Luna, MS grad (Universidad Autónoma de Nuevo León)

Alexander Kayatani, PhD graduated

James Kelley, PhD graduated

Julienne Co, MS graduated

Allan Garcia, MS graduated

Crystal Archer, MS graduated

Mayee Wong, PhD graduated

Jenny Schultz, PhD graduated

Matthew Pitts, PhD graduated

Michelle Gaither, PhD graduated

Jon Puritz, PhD graduated

Orchid Allicock, PhD graduated (Univ. West Indies)

Charles Hua, MS graduated

High school and visiting graduate students: Rachel Lui, Ashley Wang, Donalyn Naihe (STEP-UP), Selene Garcia (MS cand., Mexico), Aileen Duran; NSF REU students Kelly Claire (2012), Anna Moh (2013), Kye Duran (2014), Lauren Titus (2014)

**Select Presentations/
Abstracts**

Edgerton, S., Gubler, D.J., and **Bennett, S.N.** Evolution dengue virus type 3 through Indonesia: Identifying markers of Epidemic potential. Society for the Study of Evolution, Raleigh, NC, June 2014; American Society for Tropical Medicine and Hygiene, New Orleans, Nov. 1-6, 2014; Society for Integrative and Comparative Biology, West Palm Beach, Florida, January 3-7, 2015.

Martin, E., Chirivella, M., Co, J.K.G., Santiago, G.A., Gubler, D.J., Munoz-Jordan, J., **Bennett, S.N.** New Insights into the Molecular Evolution of Dengue Virus Type 4 in Puerto Rico over two Decades of Emergence. American Society for Tropical Medicine and Hygiene, New Orleans, Nov. 1-6, 2014.

Thongsripong P., Chandler, J.A., Green A., Kittayapong P., Wilcox B.A., Kapan D.D., **Bennett S.N.** Mosquito vector microbiome diversity across habitats in central Thailand endemic for dengue and other arthropod-borne diseases. American Society for Tropical Medicine and Hygiene, New Orleans, Nov. 1-6, 2014.

Duren, K., J. A. Chandler, **S. N. Bennett.** Potential Integration of Cell Fusing Agent Virus into the genome of Thai Mosquitoes *Aedes aegypti*. Society for Integrative and Comparative Biology, West Palm Beach, Florida, January 3-7, 2015.

Titus, L., **S. N. Bennett,** M. Zylberberg. Occurrence of avian malaria and a related parasite in the Eastern Sierra Nevada of California. Society for Integrative and Comparative Biology, West Palm Beach, Florida, January 3-7, 2015.

Liu, R*, Chandler, J.A., Thongsripong, P., Kimball, P., **Bennett, S.N.** Interspecific differences in microbial metagenomes of two sympatric mosquito species. Society for Microbiology and Evolution, San Juan, PR, June 8-13, 2014. *high school student of the CAS SSF program

Invited Speaker (hosted by Swei): Dengue virus evolution and emergence: how small changes can cause big epidemics. Sonoma State University, Jan. 27, 2015

Invited Speaker (hosted by Swei): Dengue virus evolution and emergence: how small changes can cause big epidemics. SFSU, Oct. 22, 2013

Invited Speaker (hosted by LeBeaud): Dengue virus evolution and how it affects epidemic activity. CHORI, Aug. 9, 2013

Invited Speaker (hosted by Barbour): The Evolutionary Dynamics of Dengue Virus and Other Zoonotic Diseases. UC Irvine, May 29, 2013

Invited Speaker FROMM Institute Feb 13, 2013

Invited Speaker Mosquito-Virus interactions. ASM June 19, 2012

Invited Speaker Rapidly evolving microbes. SETI 2012

Invited Speaker U. of Hawaii March 7, 2011 The evolution and phylodynamics of emerging infectious diseases

Invited Speaker CAS March 3, 2011 Tracing the origins of emerging infectious diseases: evolution, diversity and human health

Aubry, M., **Shannon Bennett,** Claudine Roche, Duane J Gubler, Van-Mai Cao-Lormeau. Genetic variations specific to DEN3 non virulent genotype IV. American Society of Tropical Medicine and Hygiene 59th annual Conference, Atlanta, GA, November 3-7, 2010.

Invited Speaker U. of Georgia June 14, 2010 Dengue Molecular Epidemiology and Evolutionary Dynamics

Invited Speaker: Zoology Seminar, University of Hawaii at Manoa, September 15, 2010. Bennett, S.N. The evolutionary dynamics of dengue viruses: how drift and selection conspire to generate emergent strains.

Invited Speaker: Emerging and Re-emerging Vector-Borne and Zoonotic Viral Infectious Diseases in Southeast Asia Workshop in Hanoi, Vietnam, September 9-10, 2010. **Bennett, S.N.** Bioinformatics for Emerging Infectious Diseases: Tracing Origins and Identifying Epidemiologic and Evolutionary Drivers.

Invited Speaker: NIAID Workshop on Dengue Virus Infection & Immunity in Portland, OR, Aug. 24-25, 2010. **Bennett, S. N.** Molecular Epidemiology and Evolution of Dengue Viruses Throughout Emergence.

Bennett, S. N., Drummond, A., Kapan, D. D., Munoz, J., Pybus, O., Holmes, E. C. Gubler, D. J. Epidemic dynamics revealed in dengue sequence evolution. Evolution 2010 Meeting, Portland, OR, June 25-29, 2010.

Bennett, S.N. Evolutionary Dynamics of Dengue Viruses. RCE National Meeting, Las Vegas, NV, April 11-13, 2010.

Bennett, S.N., D.D. Kapan, A. Drummond, O. Pybus, E. Holmes. Epidemic dynamics revealed in dengue sequence evolution. ASTMH, Washington, DC, Nov 17-22, 2009.

Nelson, D., Imrie, A., **Bennett, S.** Molecular Epidemiology of Influenza A (H1N1) in Hawai'i. APHA, Philadelphia, PA, Nov 7-11, 2009.

Steel, A., Gubler, D.J., Bennett, S. Natural Attenuation of a dengue type-2 virus during epidemics in the South Pacific. ASTMH, Washinton, DC, Nov 17-22, 2009.

Mueller, B.A., Paidi, M., Allicock, O., Carrington, C.V.F., Gubler, D., Bennett, S. Phylogeography and molecular evolution of dengue virus type-1 in Puerto Rico, 1981-1998. ASTMH, Washinton, DC, Nov 17-22, 2009.

Kang HJ, **Bennett SN**, Sumibcay L, Hope AG, Song JW, Cook JA, Yanagihara R. 2009. Molecular Phylogeny of a Newfound Hantavirus Harbored by the Eastern Mole (*Scalopus aquaticus*). American Journal of Tropical Medicine and Hygiene 81(5): 197-197 Supplement: Suppl. S Meeting Abstract: 686 Published: NOV 2009

Mueller, B.A., Durrell D. D. Kapan, Bruce A. Wilcox, and **Shannon N. Bennett**. Using weather variation to predict dengue fever in Puerto Rico. EcoHealth, Dec 1 – 5, 2008, Merida, Mexico.

Mueller, B. A., Jorge L. Munoz-Jordan, Duane J. Gubler, & **Shannon N. Bennett**. Comparative Molecular Evolution of Dengue in Puerto Rico. RCMJ Dec 1- 5, 2008, Honolulu HI; MEEGID IX, Oct 29-Nov 1, 2008, Irvine CA; Second International Conference on Dengue and Dengue Hemorrhagic Fever. October 15-17, 2008, Phuket, Thailand. **STUDENT TRAVEL AWARD FOR ABSTRACT, AWARD FOR BEST STUDENT POSTER PRESENTATION**

Mueller, B. A., Winchester J, Kapan DD, Wilcox BA, **Bennett SN**. 2008. Potential effects of climate change on vector-borne diseases. 58th annual meeting of the American Institute of Biological Sciences, Climate, Environment, and Infectious Disease, May 11-13, 2008, Arlington, VA.

Steel, A., Duane J. Gubler, **Shannon N. Bennett**. Whole-genome Phylogenetic Analysis of Outbreaks of Dengue Type-2 in the South Pacific. RCMJ Dec 1- 5, 2008, Honolulu HI; Second International Conference on Dengue and Dengue Hemorrhagic Fever. October 15-17, 2008, Phuket, Thailand. **STUDENT TRAVEL AWARD FOR ABSTRACT**

Henry, A. B., P. Thongsripong, D. Kapan, B.A. Wilcox, **S.N. Bennett**, P. Kittayapong Comparing dengue epidemiology with variation in community structure for a two-vector system in a province undergoing urbanization. Epidemics, First International Conference on Infectious Disease Dynamics, December 1-3, 2008, Asilomar, California (Accepted but not presented due to the closure of Bangkok's international airport.

Henry, A. B., P. Thongsripong, **S. N. Bennett**, Durrell D. Kapan, B. A. Wilcox, and Pattamaporn Kittayapong. 2008. Variation in catch-rate for a two-vector system across a landscape undergoing urbanization. Second International Conference on Dengue and Dengue Hemorrhagic Fever. October 15-17, 2008, Phuket, Thailand.

White WA, Akins C, Steel A, **Bennett SN**. The Molecular Basis for Epidemic Variation of Dengue-2 in the South Pacific. J. A. Burns School of Medicine INBRE Program, Honolulu, HI, July 2007 **AWARD – BEST STUDENT POSTER PRESENTATION**

Dept. of Tropical Medicine Seminar, University of Hawaii, October 2007. “Dengue Molecular Epidemiology and Evolution in the South Pacific.”

Bennett, S.N., C. Akins, A. Duran, A. Steel, C. B. Cropp, V. R. Nerurkar and D. J. Gubler. Evolution of Emergent Dengue Virus: Viral Genotypic Effects on Epidemic Potential. NIAID Regional Center of Excellence Fourth Annual Meeting: April 15-17, 2007, St. Louis, MO.

Invited Speaker: Bioinformatics Colloquium of the RCMI, CTSA planning grant, INBRE, and the Pacific Center for Emerging Infectious Diseases Research, University of Hawaii. March 6, 2007, JA Burns School of Medicine, UH. “Evolution of Infectious Diseases: Phylogenetics and Phylodynamics.”

Invited Speaker: Recent Advances in Conservation Genetics, by Stephen J. O’Brien, National Cancer Institute, January 17, 2007, at HIMB, University of Hawaii. “Phylogenetics: from Phylodynamics to Host Specificity and Adaptation in Disease Emergence.”

Invited Speaker: ESRI GIS Disease Surveillance Summit, November 28, 2006, East-West Center, Honolulu, HI. ***Bennett, S. N.**, Kapan, D. D., Wilcox, B. A. Emerging Infectious Disease: New Frameworks for the Analysis of Disease Emergence in the Asia Pacific Region, A Case Study in the ecology & evolution of avian influenza (H5N1).

*Kapan, D.D., ***Bennett, S. N.**, Wilcox, B. A. An Evolutionary Ecological Approach to Understanding Avian Influenza (H5N1) Risk. *EcoHealth One*, October 6-10, 2006, Madison WI.

Bennett, S.N.*, C. Akins, A. Duran, C. B. Cropp, V. R. Nerurkar and D. J. Gubler. Viral Genetic Mutations Associated with Disease Emergence in Dengue: Adaptive Value and Phenotypic Effects. **American Society for Virology** 25th Annual Meeting, July 15-19, 2006 at the University of Wisconsin-Madison.

American Society of Microbiologists-Hawaii Branch, June 2006, Honolulu, HI. Aileen Duran*, Chase Akins, Duane J. Gubler, Vivek R. Nerurkar, Shannon N. Bennett. Adaptive Evolution in Emergent Dengue Virus.

Bennett, S.N.*, C. Akins, A. Duran, C. B. Cropp, V. R. Nerurkar and D. J. Gubler. Viral Genetic Mutations Associated with Disease Emergence in Dengue: Adaptive Value and Phenotypic Effects. **NIAID Regional Center of Excellence** Third Annual Meeting: March 26-28, 2006, New York, NY.

Bennett, S.N.*, Vorndam, A.V., McMillan, O.W., and Gubler, D.J. Comparative Dengue Virus Evolution in Puerto Rico: molecular change and demographics in different virus serotypes. **2nd Asian Regional Dengue Research Network Meeting**, Sept. 28-30, 2005, Singapore.

Invited Speaker: Institute for Mathematical Sciences, National University of Singapore, Molecular analysis of infectious diseases, Sept. 12-16, 2005. ***Bennett, S. N.**, Holmes, E. C., McMillan, W. O., Gubler, D. J. Long-term phylogenetic history of dengue from Puerto Rico demonstrates selection and population dynamics in sequence evolution.

Bennett, S.N., A. J. Drummond, O. G. Pybus, D. D. Kapan, E. C. Holmes. Predictive model of dengue population expansion tested against effective population size estimations from sequence data. American Society of Microbiologists – IUMS, San Francisco, July 23 – 28, 2005.

Invited Speaker: Dept. of Tropical Medicine Seminar Series, University of Hawaii, May 2005. ***Bennett, S. N.**, Holmes, E. C., McMillan, W. O., Gubler, D. J. Evolution of dengue 2 in Puerto Rico: selection on envelope accompanies strain replacement.

Bennett, S.N. Comparative Viral Evolution in the Caribbean: population demography of different dengue serotypes. American Society of Parasitologists (ASP), 78rd Annual Meeting at Halifax, NS, August 1-5, 2003.

Bennett, S.N. Alternative mode of viral evolution in emergent dengue. 10th International Congress of Parasitology at Vancouver, B.C., August 4-9, 2002.

Popular Presentations/Media

City Arts & Lecture, SF, March 4, 2015, "Surprising Benefits of Bacteria: The Human Microbiome" in Conversation with Dr. Katherine Pollard.

<http://www.calacademy.org/events/conversations-on-science/surprising-benefits-of-bacteria-the-human-microbiome>

California Academy of Sciences Brilliant!Science Festival: Pandemics and Outbreak NightLife: lightening science rounds with Bay Area scientists on pandemics of humans and other animals, their origins, impacts and prevention. September 25, 2014.

City Arts & Lecture, SF, March 11, 2014, "Pandemics, A Plan for the Planet" in Conversation with Dr. Nathan Wolfe.

The Examiner January 2013, on Microbes, and CAS's first Brilliant!Science Festival.

ABC 7 News Sept 2012, mosquitoes and West Nile virus in San Francisco and the bat area

NBC News with Doug McConnell Fall 2011, on catching mosquitoes in the bay area, and their importance in infectious disease transmission.

CBC Radio Fall 1997, interviewed by CBC radio, "The Afternoon Show" with Catherine Gretzinger, on parasites and the use of popular media (The "Alien" series) in teaching parasitology.

BCTV News Summer 1995, interviewed by BCTV News with Mike McArtyl, on the parasites of subtidal local fishes.

Skills Bioinformatics and biostatistics, including phylogenetic, molecular evolutionary, population genetic, and next-generation sequencing.

Molecular & virologic laboratory techniques: DNA extraction/purification, cloning, (real-time, RT) PCR, library development, sequencing; cell culture, fluorescent antibody staining, plaque assays, mosquito husbandry.

Classic parasitology: field experience in marine & terrestrial environments; parasite ecology, natural history & identification, including systematics; tissue storage/preparation; microscopy (standard, SEM/TEM, photographic); histology; host ecology; mosquito collection and identification, medical entomology.

Effective communicator: extensive experience teaching/presenting, public relations.

Avian somnification (chicken hypnotism)

Secondary languages: French, Spanish

References

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