

BIOGRAPHICAL SKETCH

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NAME: Padilla, Norma Renee

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

POSITION TITLE: Assistant Professor/Team Lead of the Medical Entomology and Malaria Unit at the Center for Health Studies, Universidad del Valle de Guatemala

EDUCATION/FORMACION (*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
Universidad del Valle de Guatemala,	Licenciatura	1985	Biology
Universidad de Panamá, Panamá.	MSc	1989	Medical Entomology
Liverpool School of Tropical Medicine, University of Liverpool, Liverpool, UK	PhD	1998	Tropical Medicine

A. Personal statement

My role in this project is that of a research vector biologist, and will provide overall coordination and operationalization of all the study activities in Guatemala. I have over 20 years of experience in medical entomology and vector biology research related to the epidemiology and control of mosquito-borne diseases, including vector bionomics, larval and adult vector control strategies, insecticide resistance and the development of entomological surveillance systems. I have worked extensively to promote and deliver cost-effective vector control interventions for Latin American settings, allowing me to gather considerable experience to provide technical leadership, planning, managing, and implementing control intervention projects in close collaboration with the Ministries of Health. I have successfully designed, implemented, directed, and managed malaria and other vector-borne diseases research activities. The combination of this multidisciplinary work and the extended history of collaborating with regional Ministries of Health prepared me to become the coordinator of the EntoNet, a regional network that aims to strengthen entomological surveillance and vector control in the Central American region and Dominican Republic. The current application builds on my prior work and I am enthusiastic about working with the team in this study.

B. Positions, Scientific Appointments, and Honors**Positions and Employment**

1986-1990	RESEARCH FELLOW, Gorgas Memorial Laboratory, Panama.
1990-1997	RESEARCH ENTOMOLOGIST, Medical Entomology Research and Training Unit, Guatemala, US Centers for Disease Control and Prevention, CDC Guatemala.
1998-2004	SENIOR MALARIA RESEARCHER, Medical Entomology and Malaria Unit, Center for Health Studies (CES), Universidad del Valle de Guatemala
2005-present	ASSOCIATE PROFESSOR/Medical Entomology and Malaria UNIT, Center for Health Studies (CES,) Universidad del Valle de Guatemala.
2001-2016	CONSULTANT/SENIOR GUEST RESEARCHER, Amazon Malaria Initiative, US Centers for Disease Control (CDC).
2014-2017	REGIONAL COORDINATOR FOR THE INITIATIVE OF MALARIA ELIMINATION IN CENTRAL AMERICA AND THE HISPANIOLA ISLAND (EMMIE). Population Service International PSI.

2019-2020 Tephinet Contractor to support CDC/CAR Dengue preparedness and response activities in Honduras

Scientific Appointments

2008-present Member of the USA Medical Entomology (ACME)
 2010-2015 Member Malaria Task Force Mesoamerican Health Initiative 2015
 2006-present Guatemalan Advisory National Malaria Committee
 2009-2016 Member, Malaria in Pregnancy Consortium, MiP
 2001-2015 Member, Steering Committee, Amazon Malaria Initiative, United States Agency for International Development, USAID.
 2017-present Coordinator of the EntoNet, Network for Entomological Surveillance and the Technical Advisory Committee in Entomology (GTEE) of the COMISCA.
 2020-present Member of the Guatemala National Academy of Science.

D.Honors

1985 World Health Organization, PAHOWHO, Scholarship Award to obtain a Masters in Science degree
 1995 Tropical Disease Research/World Health Organization, TDRWHO Scholarships Award to obtain a PhD degree.
 1998 Gorgas Award in Tropical Medicine Research, Gorgas Memorial Institute Research Fellowship, Post Doc fellow

C. Contribution to Science

1. Biology and Ecology of Malaria Vectors

Malaria transmission is still poorly characterized in Guatemala and the Central American region. Throughout my career, my research has focused on vector biology and the importance of understanding mosquitoes' ecology, bionomics and genetics to reduce malaria and burden. These publications document the early studies to incriminate anopheline species as malaria vectors "a" and "b", their role in extending an sustaining transmission cycle during the transeasonal cycle by secondary vectors, such as *An. vestitipennis*, and the development and population genetics studies to understand the structure of *Anopheles* populations using microsatellites "c" and "d".

Role: PI and Co-PI

- a. Dix M, Darsie R, Molina P, Rodriguez L, **Padilla N**, Juárez J. 1991. *Anopheles neomaculipalpus*, first record for Guatemala. *Journal of the American Mosquito Control Association*, 7(2):330.
- b. **Padilla N**, Molina CP, Juárez J, Bown D, Cordón-Rosales C. 1992. Potential malaria vectors in northern Guatemala. *Journal of the American Mosquito Control Association*, 8(3):311.
- c. Mirabello L, Vineis JH, Yanoviak SP, Scarpassa VM, Póvoa MM, **Padilla N**, Grieco JP, Conn JE. 2008. Microsatellite data suggest significant population structure and differentiation within the malaria vector *Anopheles darlingi* in Central and South America. *BMC Evolutionary Biology*, 26(8):3.
- d. Penilla RP, Ranson H, **Padilla N**, Morgan JC, Steen K, Pignatelli P, Rodríguez AD, Hemingway J, Brogdon WG, Black WC, Benedict MQ. 2009. Towards a genetic map for *Anopheles albimanus*: identification of microsatellite markers and a preliminary linkage map for chromosome 2. *American Journal of Tropical Medicine and Hygiene*, 81(6):1007.

2. Malaria Elimination

An unprecedented decrease in cases in malaria cases, in more that 90% Central America committed to eliminate malaria by the 2020. Two main reasons threats any elimination program, the resurgence due to introduction of cases by mobile and migrant population and the implemetacon of non effective control tools. Over the years we have been documenting the occurrence of outbreaks in Guatemala. Publication "a" to "d" resume some of the work and recentry in publication of the efficacy of LLINs "f".

Role PI and CO-PI

- a. Arevalo-Herrera M, Quiñones ML, Guerra C, Céspedes N, Giron S, Ahumada M, Piñeros JG, Padilla N, Terrientes Z, Rosas A, Padilla JC, Escalante AA, Beier JC, Herrera S. 2012. Malaria in selected non-

Amazonian countries of Latin America. *Acta Tropica*, 121(3):303.

- b. Juliao PC, Sosa S, Gonzalez LD, Padilla N, Ortiz L, Goldman I, Udhayakumar V, Lindblade KA. 2013. Importation of chloroquine-resistant *Plasmodium falciparum* by Guatemalan peacekeepers returning from the Democratic Republic of the Congo. *Malaria Journal*, 12:344.
- c. Patel JC, Taylor SM, Juliao PC, Parobek CM, Janko M, Gonzalez LD, Ortiz L, Padilla N, Tshefu AK, Emch M, Udhayakumar V, Lindblade K, Meshnick S. 2014. Genetic evidence of importation of drug-resistance *Plasmodium falciparum* to Guatemala from the Democratic Republic of the Congo. *Emerging Infectious Diseases*, 20(6):932.
- d. Castellanos ME, Díaz S, Parsons E, Peruski L, Enríquez F, Ramírez JL, Padilla N. 2015. First imported *Plasmodium ovale* malaria in Central America: case report of a Guatemalan soldier and a call to improve its accurate diagnosis. *Military Medical Research* 2:3.
- e. Cohen R, Cardona JS, Navarro ES, Padilla N, Reyes L, Villar RJP, Masuoka P, Bernart C, Peruski LF, Bryan JP. 2017. Outbreak Investigation of *Plasmodium vivax* Malaria in a Region of Guatemala Targeted for Malaria Elimination. *Am J Trop Med Hyg*. 2017 Apr;
- f. M.E. Castellanos, S. Rodas, J.G. Juárez, J. C Lol, S. Chanquin, Z. Morales, L. Vizcaino, S, C. Smith, J. Vanden Eng, H.G. Woldu, A. Lenhart and **N. Padilla**. 2021. Evaluation of the durability of long-lasting insecticidal nets in Guatemala. *Malaria Journal*. 20:219.

3. Insecticide Resistance

The lack of molecular tools to characterize resistance in malaria vectors in the Americas has impeded the development of comprehensive resistance diagnostics, which are critical for the development of resistance management plans. In collaboration with other research groups we have developed molecular tools that now allowed to diagnose resistance in the main malaria vectors in the region. These findings which are set forth in publications “b” to e” collectively represent the first markers to characterize point mutation resistance and to identify genes associated with metabolic resistance. A deeper understanding of the mechanisms underlying insecticide resistance is needed to mitigate its threat to mosquito control. Results in publication “d” show that insecticide exposure alters mosquito bacterial communities, and demonstrate how insecticide pressure could be selecting for certain bacteria within mosquitoes, thus potentially contributing to insecticide resistance. Role: PI and Co-PI

- a. Lol JC, Castellanos ME, Liebman KA, Lenhart A, Pennington PM, **Padilla N**. 2013. Molecular evidence for historical presence of knock-down resistance in *Anopheles albimanus*, a key malaria vector in Latin America. *Parasite & Vectors*, 6:268.
- b. Mackenzie-Impoinvil L, Weedall GD, Lol JC, Pinto J, Vizcaino L, Dzuris N, J Riveron, **N Padilla**, C Wondji, A Lenhart . (2019) Contrasting patterns of gene expression indicate differing pyrethroid resistance mechanisms across the range of the New World malaria vector *Anopheles albimanus*. *PLoS ONE* 14(1): e0210586. <https://doi.org/10.1371/journal.pone.0210586>.
- c. JC Lol; Edwin David Castañeda; Lucy Mackenzie-Impoinvil; Carla G Romero; Audrey Lenhart; **Norma Padilla**. Development of molecular assays to detect target-site mechanisms associated with insecticide resistance in malaria vectors from Latin America. 2019. *Malaria Journal*. DOI: 10.1186/s12936-019-2834-7.
- d. Dada, Nsa, J. Lol, AC. Benedict. F. López, M. Sheth, N. Dzuris, **N. Padilla** and A. Lenhart. 2019. Pyrethroid exposure alters internal and cuticle surface bacterial communities in *Anopheles albimanus*. *ISME Journal*. Jun 6. <https://doi.org/10.1038/s41396-019-0445-5>.
- e. Zardkoohi A., Castañeda D., Lol JC.,Castillo C., Lopez F., Marin Rodriguez R., **Padilla N**. 2019. Co-occurrence of kdr Mutations V1016I and F1534C and Its Association With Phenotypic Resistance to Pyrethroids in *Aedes aegypti* (Diptera: Culicidae) Populations from Costa Rica. DOI:10.1093/jme/tjz241.
- f. Dada, N, A.C. Benedict, F.López, J.C. Lol, M. Sheth, N. Dzuris^a, **N. Padilla** and A. Lenhart. 2020. *Anopheles albimanus* natural microbiota is altered within one generation of laboratory colonization. bioRxiv preprint doi: <https://doi.org/10.1101/2020.06.02.129619>.

4. Malaria in Pregnancy

In additions to the contributions described above, as PI and CO-PI and in collaboration with other research groups I have also led epidemiological research documenting the impact of *Plasmodium vivax* malaria in pregnancy. This set of publications constitute the first comprehensive study in the role of *Plasmodium vivax* malaria in pregnancy across distinct epidemiological settings conducted by the PregVax Consortium and the Malaria in Pregnancy Consortium that lasted more than 5 years. With these papers, the impact of *Plasmodium vivax* malaria in pregnant woman and newborns is been elucidated, as well as the role of microscopic infections in pregnancy outcomes and as a reservoir of malaria in elimination settings. Role: PI and Co-PI

- a. Castellanos ME, Bardají A, Menegon M, Mayor A, Desai M, Severini C, Menéndez C, **Padilla N**. 2012. *Plasmodium vivax* congenital malaria in an area of low endemicity in Guatemala: implications for clinical and epidemiological surveillance in a malaria elimination context. *Malaria Journal*, 11:411.
- b. Menegon M, Bardají A, Martínez-Espinoza F, Bôtto-Menezes C, Ome-Kaius M, Mueller I, Betuela I, Arévalo-Herrera M, Kochar S, Kochar SK, Jaju P, Hans D, Chitnis C, **Padilla N**, Castellanos ME, Ortiz L, Sanz S, Piqueras M, Desai M, Mayor A, Del Portillo H, Menéndez C, Severini C. 2016. Microsatellite genotyping of *Plasmodium vivax* isolates from pregnant women in four malaria endemic countries. *PLoS ONE* 11(3):e015244.
- c. Requena P, Rui E, Padilla N, **Martínez-Espinoza FE**, Castellanos ME, Bôtto-Menezes C, Malheiro A, Arévalo-Herrera M, Kochar S, Kochar SK, Kochar DK, Umbers AJ, Ome-Kaius M, Wangnapi R, Hans D, Menegon M, Mateo F, Sanz S, Desai M, Mayor A, Chitnis CC, Bardají A, Mueller I, Rogerson S, Severini C, Fernández-Becerra C, Menéndez C, Del Portillo H, Dobaño C. 2016. Plasmodium vivax VIR proteins are targets of naturally-acquired antibody and T Cell Immune responses to malaria in pregnant women. *PLoS Negl Trop Dis*. 2016 Oct 6;10(10):e0005009. doi: 10.1371/journal.pntd.0005009. eCollection 2016 Oct
- d. Quintó L, García-Basteiro AL, Bardají A, González R, Padilla N, Martínez-Espinoza FE, Arévalo-Herrera M, Macete E, Menéndez C. 2017. The Challenge of Assessing Microcephaly in the Context of the Zika Virus Epidemic. *J. Trp. Pediatrics*. 1;63(6):495-498
- e. Requena P, Rui E, Padilla N, Martínez-Espinoza FE, Castellanos ME, Bôtto-Menezes C, Malheiro A, Arévalo-Herrera M, Kochar S, Kochar SK, Kochar DK, Umbers AJ, Ome-Kaius M, Wangnapi R, Hans D, Menegon M, Mateo F, Sanz S, Desai M, Mayor A, Chitnis CC, Bardají A, Mueller I, Rogerson S, Severini C, Fernández-Becerra C, Menéndez C, Del Portillo H, Dobaño C. 2016. *Plasmodium vivax* VIR Proteins Are Targets of Naturally-Acquired Antibody and T Cell Immune Responses to Malaria in Pregnant Women. *Plos. Negl.Trop. Dis*. 2016 Oct 6;10(10):e0005009. doi: 10.1371/journal.pntd.0005009. eCollection 2016 Oct
- f. Burden and impact of *Plasmodium vivax* in pregnancy: A multi-centre prospective observational study. A. Bardají, F. Martínez-Espinoza, M. Arévalo-Herrera, N. Padilla, *et al*. On behalf of the PregVax Study Group. 2017. *PLos Neglected Tropical Diseases*. <https://doi.org/10.1371/journal.pntd.0005606>
- g. Requena P, Arévalo-Herrera M, Menegon M, Martínez-Espinoza FE, **Padilla N**, Bôtto-Menezes C, Malheiro A, Hans D, Castellanos ME, Robinson L, Samol P, Kochar S, Kochar SK, Kochar DK, Desai M, Sanz S, Quintó L, Mayor A, Rogerson S, Mueller I, Severini C, Del Portillo HA, Bardají A, Chitnis CC, Menéndez C, Dobaño C. Naturally Acquired Binding-Inhibitory Antibodies to *Plasmodium vivax* Duffy Binding Protein in Pregnant Women Are Associated with Higher Birth Weight in a Multicenter Study. *Front Immunol*. 2017 Feb 17;8:163. doi: 10.3389/fimmu.2017.00163. eCollection 2017

5. Field Epidemiology Assesments

Experience in the conduction of complex surveys given me the opportunity to contribute in other field of study such access to health services, assessment of community base and health facility surveillance. Role: Co-PI.

- a. Sejvar JJ, Lindblade KA, Arvelo W, **Padilla N**, Pringle K, Zielinski-Gutierrez E, Farnon E, Schonberger LB, Dueger E. 2010. Clinical assessment of self-reported acute flaccid paralysis in a population-based setting in Guatemala. *American Journal of Tropical Medicine and Hygiene*, 82(4):712.
- b. Lindblade KA, Johnson AJ, Arvelo W, Zhang X, Jordan HT, Reyes L, Fry AM, **Padilla N**. 2011. Low usage of government healthcare facilities for acute respiratory infections in Guatemala: Implications for

influence surveillance. *BMC Public Health*, 11:885.

Complete List of Published Work in MyBibliography:

<https://www.ncbi.nlm.nih.gov/pubmed/?term=Norma+Padilla>

D. Additional Information: Research Support and/or Scholastic Performance

Ongoing Research Support

CDC/UVG Cooperative Agreement CoAg GH 002243-01 2020-2025
Strengthening the preparedness and response to vector borne diseases EntoNet: development of a network of public health entomologists in Central America.
Role: PI

CDC/UVG Cooperative Agreement CoAg GH 002243-01 2019-2024
Characterizing insecticide resistance in populations of *Aedes aegypti* and *Ae. albopictus* in Central America and Dominican Republic.
Role: PI

Completed Research Support

CDC/UVG Cooperative Agreement IU51GH000970-01; 2016-2018
Strengthening Entomological Surveillance for *Aedes spp* within the integrated vector management framework.
Role: PI

CDC/UVG Cooperative Agreement 5U01GH001003-03 2016-2018
Improved *Aedes aegypti* Surveillance to Prevent Acute Neurological and Febrile Illness in Central America
Role: PI

CDC/UVG Cooperative Agreement 5U01GH001003-03 2013-2016
Understanding insecticide resistance in the main malaria vectors from Latin America and factors that modulate its emergence and spread.
Role: PI.

CDC/UVG Cooperative Agreement 5U01GH001003-03 2013-2017
Studies of host seeking mosquito interactions with treated and untreated bed nets in laboratory and field settings
Role: PI.

CDC/UVG Cooperative Agreement 5U51GH000011 2013-2017
Testing the Durability of Long-Lasting Insecticidal nets under routine use
Role: PI.

CDC Foundation MOA #458-0100-09 2009-2014
The burden and Spatial epidemiology of malaria in pregnancy in Latin America
Role: PI

EU-FP-7 201588 2008-2014
Plasmodium vivax infection in pregnancy
Role: Co-PI

USAID 2000-2005
The impact of community-wide use of insecticide treated bednets on malaria transmission in Guatemala.
Role: CO-PI