

ANDRE LUIS COSTA-DA-SILVA

Assistant Professor, Florida International University
Department of Biological Sciences & Biomolecular Sciences Institute
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Education

University of Sao Paulo (USP)

Ph.D. in Sciences, Biology of Host-Pathogen Interactions

Degree awarded in 04/2011

Thesis title: "Identification and molecular analysis of genes expressed at the end of *Aedes aegypti* gonotrophic cycle"

University of Mogi das Cruzes (UMC)

Bachelor of Biological Sciences

Completed in 12/2004 – Degree awarded in 02/2005

University of Mogi das Cruzes (UMC)

Full Teaching Degree in Biological Sciences

Completed in 12/2003 – Degree awarded in 01/2004

Monograph: "Genetic variability of mtDNA NADH4 fragment in *Aedes (Stegomyia) aegypti* Peruvian populations"

Research Positions

Florida International University

Assistant Professor

2026-Present

HostArVec Lab – Principal Investigator, Department of Biological Sciences

My laboratory investigates the molecular and ecological determinants of arboviral transmission by integrating molecular virology, vector biology, and virus–vector–human host interactions. The overarching goal is to identify vulnerabilities across the arbovirus–vector–human interface to develop precision strategies for preventing arboviral transmission.

Florida International University

Research Assistant Professor

2021-2026

Supervisor: Matthew DeGennaro

Laboratory of Tropical Genetics, Department of Biological Sciences

Studying mosquito behavior and neurogenetics for behavioral manipulation
Leading field projects to model mosquito infestation predictions
Developing a machine-learning-based app for mosquito egg counting
Investigating mosquito impact on breeding-site microbiomes during oviposition
Designing assays and devices for mosquito behavior research

Operating an insect microinjection facility
Managing field-collected mosquito lines and lab strains

Florida International University

Postdoctoral Research Associate

2017-2021

Mentor: Matthew DeGennaro

Laboratory of Tropical Genetics, Department of Biological Sciences

Leading projects to develop mosquito attractants and traps
Conducting neurogenetic studies on mosquito oviposition
Operating an insect microinjection facility
Managing field-collected mosquito lines

University of Sao Paulo

Postdoctoral Research Associate

2011-2017

Mentor: Margareth Capurro

Laboratory of Genetically Modified Mosquitoes, Department of Parasitology

Managed entomological activities for the Zika Task Force (field and lab)
Developed and tested transgenic lines for Dengue refractory traits
Performed infection, detection, and quantification of flaviviruses in mosquitoes

University of Sao Paulo

Doctoral Student

2005-2011

Mentor: Margareth Capurro

Laboratory of Genetically Modified Mosquitoes, Department of Parasitology

Identified genes expressed late in the *Aedes aegypti* gonotrophic cycle
Constructed plasmids to study mosquito promoters
Conducted mosquito embryo microinjections to create transgenic lines

Superintendency for Endemic Disease Control (SUCEN), Sao Paulo

Undergraduate Student

2003-2005

Mentor: Jose Eduardo Bracco

Laboratory of Vector Biochemistry and Molecular Biology

Conducted population genetics studies on Peruvian *Aedes aegypti*

Biological Institute, Sao Paulo

Undergraduate Research Trainee

2002

Mentor: Mario Barreto Figueiredo

Laboratory of Phyto pathological Mycology

Evaluated fungal viability after long periods of preservation

Peer-reviewed Publications (35 total)

(10 first-author • 1 co-first author • 1 senior author • 7 corresponding-author publications)

1. Marrero KM, Castillo JS, Lucas-Barbosa D, Bellantuono AJ, Marrero MA, Cid D, **Costa-da-Silva AL**, Verhulst NO, DeGennaro M. **2026**. Individual humans are more attractive to certain mosquito species. *iScience*. Jul 31;29(8):117006. doi: [10.1016/j.isci.2026.117006](https://doi.org/10.1016/j.isci.2026.117006)

2. Silva FAA, Scomparim G, Costa GCA, Manzato VM, Torquato RJS, **Costa-da-Silva AL**, Lemos FJA, Tanaka AS. **2026**. A novel Kazal-type protease inhibitor from *Aedes aegypti* effective for NS2B-NS3 protease from the Zika virus and subtilases. *Arch Biochem Biophys*. Jun 20;783:110908. doi: [10.1016/j.abb.2026.110908](https://doi.org/10.1016/j.abb.2026.110908)

3. Gupta S, Sharma R, Williams AE, Sanchez-Vargas I, Rose NH, Zhang C, Crosbie-Villaseca A, Kyza-Karavioti M, Zhu Z, Dayama G, Gloria-Soria A, Brackney DE, Manning J, Wheeler SS, Caranci A, Reyes T, Sylla M, Badolo A, Akorli J, Aribodor OB, Ayala D, Liu WL, Chen CH, Vasquez C, Acosta CG, Ponlawat A, Magalhaes T, Carter BH, Wesson DM, Surin D, Younger MA, **Costa-da-Silva AL**, DeGennaro M, Bergman A, Lambrechts L, McBride CS, Olson KE, Calvo E, Lau NC. **2026**. Small RNA genomics of *Aedes aegypti* mosquitoes discovers infectious viruses that trigger an RNA interference response. *Nat Commun*. Apr 23;17(1):3658. doi: [10.1038/s41467-026-71964-1](https://doi.org/10.1038/s41467-026-71964-1)

4. Jibowu M, Vigilant M, **Costa-da-Silva AL**, Nelson A, Essigmann HT, Brown EL, Gunter SM. **2025**. Spatial and seasonal dynamics of mosquito species in Harris County, Texas, highlight risk of arbovirus introduction and transmission. *Sci Rep*. Mar 25;15(1):10330. doi: [10.1038/s41598-025-92175-6](https://doi.org/10.1038/s41598-025-92175-6)

5. **Costa-da-Silva AL**, Dye-Braumuller KC, Wagner-Coello HU, Li H, Johnson-Carson D, Gunter SM, Nolan MS, DeGennaro M. **2024**. Landscape and meteorological variables associated with *Aedes aegypti* and *Aedes albopictus* mosquito infestation in two southeastern USA coastal cities. *J Vector Ecol*. Dec;50(1):28-38. doi: [10.52707/1081-1710-50.1-28](https://doi.org/10.52707/1081-1710-50.1-28)

6. David OG, Arce AV, **Costa-da-Silva AL**, Bellantuono AJ, DeGennaro M. **2024**. Fertility decline in *Aedes aegypti* (Diptera: Culicidae) mosquitoes is associated with reduced maternal transcript deposition and does not depend on female age. *J Med Entomol*. Jul 12;61(4):1064-1070. doi: [10.1093/jme/tjae058](https://doi.org/10.1093/jme/tjae058)

7. Ortega-Insaurralde I, Latorre-Estivalis JM, **Costa-da-Silva AL**, Cano A, Insausti TC, Morales HS, Pontes G, de Astrada MB, Ons S, DeGennaro M, Barrozo RB. **2024**. The pharyngeal taste organ of a blood-feeding insect functions in food recognition. *BMC Biol*. Mar 13;22(1):63. doi: [10.1186/s12915-024-01861-w](https://doi.org/10.1186/s12915-024-01861-w)

8. **Costa-da-Silva AL**, Cabal S, Lopez K, Boloix J, Rodriguez BG, Marrero KM, Bellantuono AJ, DeGennaro M. **2024**. Female *Aedes aegypti* mosquitoes use communal cues to manage population density at breeding sites. Commun Biol. Jan 31;7(1):143. doi: [10.1038/s42003-024-05830-5](https://doi.org/10.1038/s42003-024-05830-5)
9. Moura AS, **Costa-da-Silva AL**, Peixoto PS, Maciel C, Cardoso AF. **2023**. Vitellogenin genes are transcribed in *Culex quinquefasciatus* ovary. Mem Inst Oswaldo Cruz. Jul 17;118:e220143. doi: [10.1590/0074-02760220143](https://doi.org/10.1590/0074-02760220143)
10. David OG, Sanchez KM, Arce AV, **Costa-da-Silva AL**, Bellantuono AJ, DeGennaro M. **2023**. Fertility decline in female mosquitoes is regulated by the orco olfactory co-receptor. iScience. May 13;26(6):106883. doi: [10.1016/j.isci.2023.106883](https://doi.org/10.1016/j.isci.2023.106883)
11. Lucas-Barbosa D, Balvers C, Bellantuono, AJ, Castillo J, **Costa-da-Silva AL**, De Moraes CM, DeGennaro M, Verhulst NO. **2023**. Competition matters: using in vitro community models to study the impact of human skin bacteria on mosquito attraction. Front Ecol Evol. May 25; 11:1156311. doi: [10.3389/fevo.2023.1156311](https://doi.org/10.3389/fevo.2023.1156311)
12. Carvalho DO*, **Costa-da-Silva AL***, Petersen V, de Souza MS, Ioshino RS, Marques ICS, Franz AWE, Olson KE, James AA, Capurro ML. **2023**. Transgene-induced cell death following dengue-2 virus infection in *Aedes aegypti*. Sci Rep. Apr 12;13(1):5958. (*both authors contributed equally). doi: [10.1038/s41598-023-32895-9](https://doi.org/10.1038/s41598-023-32895-9)
13. Almeida LS, Nishiyama-Jr MY, Pedroso A, **Costa-da-Silva AL**, Ioshino RS, Capurro ML, Suesdek L. **2023**. Transcriptome profiling and Calreticulin expression in Zika virus -infected *Aedes aegypti*. Infect Genet Evol. Jan;107:105390. doi: [10.1016/j.meegid.2022.105390](https://doi.org/10.1016/j.meegid.2022.105390)
14. Cunha MDP, Ioshino RS, **Costa-da-Silva AL**, Petersen V, Capurro ML, Zanotto PMA. **2020**. A Metagenomic Approach Identified a Novel Phasi Charoen-Like Virus Coinfecting a Chikungunya Virus-Infected *Aedes aegypti* Mosquito in Brazil. Microbiol Resour Announc. Jul 30;9(31):e01572-19. doi: [10.1128/MRA.01572-19](https://doi.org/10.1128/MRA.01572-19)
15. Melo N, Wolff GH, **Costa-da-Silva AL**, Arribas R, Triana MF, Gugger M, Riffell JA, DeGennaro M, Stensmyr MC. **2020**. Geosmin Attracts *Aedes aegypti* Mosquitoes to Oviposition Sites. Curr Biol. Jan 6;30(1):127-134.e5. doi: [10.1016/j.cub.2019.11.002](https://doi.org/10.1016/j.cub.2019.11.002)
16. Oliveira FAA, Buri MV, Rodriguez BL, **Costa-da-Silva AL**, Araújo HRC, Capurro ML, Lu S, Tanaka AS. **2020**. The first characterization of a cystatin and a cathepsin L-like peptidase from *Aedes aegypti* and their possible role in DENV infection by the modulation of apoptosis. Int J Biol Macromol. Mar 1;146:141-149. doi: [10.1016/j.ijbiomac.2019.12.010](https://doi.org/10.1016/j.ijbiomac.2019.12.010)

17. Evans BR, Kotsakiozi P, **Costa-da-Silva AL**, Ioshino RS, Garziera L, Pedrosa MC, Malavasi A, Virginio JF, Capurro ML, Powell JR. **2019**. Transgenic *Aedes aegypti* Mosquitoes Transfer Genes into a Natural Population. Sci Rep. Sep10;9(1):13047. doi: [10.1038/s41598-019-49660-6](https://doi.org/10.1038/s41598-019-49660-6)
18. Ioshino RS, Carvalho DO, Marques ICS, Fernandes ES, Capurro ML, **Costa-da-Silva AL**. **2018**. Oviplate: A Convenient and Space-Saving Method to Perform Individual Oviposition Assays in *Aedes aegypti*. Insects. Aug 15;9(3). doi: [10.3390/insects9030103](https://doi.org/10.3390/insects9030103)
19. Carvalho DO, Chuffi S, Ioshino RS, Marques ICS, Fini R, Costa MK, Araújo HRC, **Costa-da-Silva AL**, Kojin BB, Capurro ML. **2018**. Mosquito pornoscropy: Observation and interruption of *Aedes aegypti* copulation to determine female polyandric event and mixed progeny. PLoS One. Mar 8;13(3):e0193164. doi: [10.1371/journal.pone.0193164](https://doi.org/10.1371/journal.pone.0193164)
20. Soares TS, Rodriguez Gonzalez BL, Torquato RJS, Lemos FJA, **Costa-da-Silva AL**, Capurro Guimarães ML, Tanaka AS. **2018**. Functional characterization of a serine protease inhibitor modulated in the infection of the *Aedes aegypti* with dengue virus. Biochimie. Jan;144:160-168. doi: [10.1016/j.biochi.2017.11.005](https://doi.org/10.1016/j.biochi.2017.11.005)
21. **Costa-da-Silva AL**, Ioshino RS, Petersen V, Lima AF, Cunha MDP, Wiley MR, Ladner JT, Prieto K, Palacios G, Costa DD, Suesdek L, Zanotto PMA, Capurro ML. **2017**. First report of naturally infected *Aedes aegypti* with chikungunya virus genotype ECSA in the Americas. PLoS Negl Trop Dis. 14;11(6):e0005630. doi: [10.1371/journal.pntd.0005630](https://doi.org/10.1371/journal.pntd.0005630)
22. **Costa-da-Silva AL**, Ioshino RS, Araújo HR, Kojin BB, Zanotto PM, Oliveira DB, Melo SR, Durigon EL, Capurro ML. **2017**. Laboratory strains of *Aedes aegypti* are competent to Brazilian Zika virus. PLoS One. 2017. 10;12(2):e0171951. doi: [10.1371/journal.pone.0171951](https://doi.org/10.1371/journal.pone.0171951)
23. Filho NAC, Oliveira PA, Oliveira FC, Pappen FG, Aguiar CLG, **Costa-da-Silva AL**, Farias NAR. **2017**. PCR-based identification of *Neospora caninum* in the umbilical cord of a newborn calf in Brazil. Ciência Rural. 47(7):01-06. doi: [10.1590/0103-8478cr20160876](https://doi.org/10.1590/0103-8478cr20160876)
24. Kojin BB, **Costa-da-Silva AL**, Maciel C, Henriques DA, Carvalho DO, Martin K, Marinotti O, James AA, Bonaldo MC, Capurro ML. **2016**. Endogenously-expressed NH2-terminus of circumsporozoite protein interferes with sporozoite invasion of mosquito salivary glands. Malar J. 15(1):153. doi: [10.1186/s12936-016-1207-8](https://doi.org/10.1186/s12936-016-1207-8)
25. Araujo HRC, Carvalho DO, Ioshino RS, **Costa-da-Silva AL**, Capurro, ML. **2015**. *Aedes aegypti* Control Strategies in Brazil: Incorporation of New Technologies to Overcome the Persistence of Dengue Epidemics. Insects. 6(2):576-594. doi: [10.3390/insects6020576](https://doi.org/10.3390/insects6020576)

26. Araujo RV, Albertini MR, **Costa-da-Silva AL**, Suesdek L, Franceschi NC, Bastos NM, Katz G, Cardoso VA, Castro BC, Capurro ML, Allegro VL. **2015**. Sao Paulo urban heat islands have a higher incidence of dengue than other urban areas. Braz J Infect Dis. 19(2):146-55. doi: [10.1016/j.bjid.2014.10.004](https://doi.org/10.1016/j.bjid.2014.10.004)
27. Moura AS, Cardoso AF, **Costa-da-Silva AL**, Winter CE, Bijovsky AT. **2015**. Two Cathepsins B Are Responsible for the Yolk Protein Hydrolysis in *Culex quinquefasciatus*. PLoS One 10: e0118736. doi: [10.1371/journal.pone.0118736](https://doi.org/10.1371/journal.pone.0118736)
28. Silva AF, Bastos EL, Torres MD, **Costa-da-Silva AL**, Ioshino RS, Capurro ML, Alves FL, Miranda A, de Freitas Fischer Vieira R, Oliveira VX Jr. **2014**. Antiplasmodial activity study of angiotensin II via Ala scan analogs. J Pept Sci. 20(8):640-8. doi: [10.1002/psc.2641](https://doi.org/10.1002/psc.2641)
29. Carvalho DO, **Costa-da-Silva AL**, Lees RS, Capurro ML. **2014**. Two step male release strategy using transgenic mosquito lines to control transmission of vector-borne diseases. Acta Trop. 132 Suppl:S170-7. doi: [10.1016/j.actatropica.2013.09.023](https://doi.org/10.1016/j.actatropica.2013.09.023)
30. **Costa-da-Silva AL**, Lorenti LS, Oliveira, SL, Cardoso F, Capurro ML. **2014**. The First Molecular Characterization of *Anopheles (Nyssorhynchus) aquasalis* (Diptera : Culicidae) Vitellogenin Expression Products and a Partial cDNA Sequence Isolation. J Med Entomol. 51: 1208–1212. doi: [10.1603/ME13045](https://doi.org/10.1603/ME13045)
31. **Costa-da-Silva AL**, Marinotti O, Ribeiro JM, Silva MC, Lopes AR, Barros MS, Sá-Nunes A, Kojin BB, Carvalho E, Suesdek L, Silva-Neto MA, James AA, Capurro ML. **2014**. Transcriptome sequencing and developmental regulation of gene expression in *Anopheles aquasalis*. PLoS Negl Trop Dis. 17;8(7):e3005. doi: [10.1371/journal.pntd.0003005](https://doi.org/10.1371/journal.pntd.0003005)
32. **Costa-da-Silva AL**, Carvalho DO, Kojin BB, Capurro ML. **2014**. Implementation of the Artificial Feeders in Hematophagous Arthropod Research Cooperates to the Vertebrate Animal Use Replacement, Reduction and Refinement (3Rs) Principle. J Clin Res Bioeth. 5: 167. doi:[10.4172/2155-9627.1000167](https://doi.org/10.4172/2155-9627.1000167)
33. **Costa-da-Silva AL**, Kojin BB, Marinotti O, James AA, Capurro ML. **2013**. Expression and accumulation of the two-domain odorant-binding protein AaegOBP45 in the ovaries of blood-fed *Aedes aegypti*. Parasit Vectors. 24;6:364. doi: [10.1186/1756-3305-6-364](https://doi.org/10.1186/1756-3305-6-364)
34. **Costa-da-Silva AL**, Navarrete FR, Salvador FS, Karina-Costa M, Ioshino RS, Azevedo DS, Rocha DR, Romano CM, Capurro ML. **2013**. Glytube: a conical tube and parafilm M-based method as a simplified device to artificially blood-feed the dengue vector mosquito, *Aedes aegypti*. PLoS One. 8(1):e53816. doi: [10.1371/journal.pone.0053816](https://doi.org/10.1371/journal.pone.0053816)

35. **da Costa-da-Silva AL**, Capurro ML, Bracco JE. **2005**. Genetic lineages in the yellow fever mosquito *Aedes* (*Stegomyia*) *aegypti* (Diptera: Culicidae) from Peru. *Mem Inst Oswaldo Cruz*. 100(6):539-44.
doi: [10.1590/s0074-02762005000600007](https://doi.org/10.1590/s0074-02762005000600007)

Google Scholar [indicators](#):

Total citations: 1,406

h-index: 15

i10-index: 23

Preprints

1. MacInnis AE, **Costa-da-Silva AL**, Bellantuono AJ, DeGennaro M & Wells JD. **2026**. A genetically marked maggot to better understand corpse decomposition ecology. *Research Square*
<https://doi.org/10.21203/rs.3.rs-9783362/v1>
2. Marrero KM, Castillo JS, Lucas-Barbosa D, Bellantuono AJ, Marrero MA, Cid D, **Costa-da-Silva AL**, Verhulst NO, DeGennaro M. **2026**. Individual humans attract different mosquito species. *bioRxiv* 2026.01.30.702931. doi: [10.64898/2026.01.30.702931](https://doi.org/10.64898/2026.01.30.702931)
3. **Costa-da-Silva AL**, Dye-Braumuller KC, Wagner-Coello HU, Li H, Johnson-Carson D., Gunter SM, Nolan MS, DeGennaro M. **2024**. Landscape and meteorological variables associated with *Aedes aegypti* and *Aedes albopictus* mosquito infestation in two southeastern USA coastal cities. *bioRxiv* 2024.06.06.597792; doi: [10.1101/2024.06.06.597792](https://doi.org/10.1101/2024.06.06.597792)
4. Gupta S, Sharma R, Williams AE, Sanchez-Vargas I, Rose NH, Zhang C, Crosbie-Villaseca A, Zhu Z, Dayama G, Gloria-Soria A, Brackney DE, Manning J, Wheeler SS, Caranci A, Reyes T, Sylla M, Badolo A, Akorli J, Aribodor OB, Ayala D, Liu WL, Chen CH, Vasquez C, Acosta CG, Ponlawat A, Magalhaes T, Carter B, Wesson D, Surin D, Younger MA, **Costa-da-Silva AL**, DeGennaro M, Bergman A, Lambrechts L, McBride CS, Olson KE, Calvo E, Lau NC. **2024**. Global genomics of *Aedes aegypti* unveils widespread and novel infectious viruses capable of triggering a small RNA response. *bioRxiv* 2024.06.06.597482; doi: [10.1101/2024.06.06.597482](https://doi.org/10.1101/2024.06.06.597482)
5. David OG, Arce AV, **Costa-da-Silva AL**, Bellantuono AJ, DeGennaro M. **2023**. Fertility decline in *Aedes* mosquitoes is associated with reduced maternal transcript deposition and does not depend on female age. *bioRxiv* 2023.12.05.570316; doi: [10.1101/2023.12.05.570316](https://doi.org/10.1101/2023.12.05.570316)
6. David OG, Sanchez KM, Arce AV, **Costa-da-Silva AL**, Bellantuono AJ, DeGennaro M. **2023**. Fertility decline in female mosquitoes is regulated by the orco olfactory co-receptor. *bioRxiv* 2023.01.07.523099 doi: [10.1101/2023.01.07.523099](https://doi.org/10.1101/2023.01.07.523099)

7. Ortega-Insaurralde I, Latorre-Estivalis JM, **Costa-da-Silva AL**, Cano A, Insausti TC, Salas Morales H, Pontes G, Berón de Astrada M, Ons S, DeGennaro M, Barrozo RB. **2022**. Food recognition in a blood-feeding insect: characterization of the pharyngeal taste organ. *bioRxiv* 2022.11.15.516640. doi: [10.1101/2022.11.15.516640](https://doi.org/10.1101/2022.11.15.516640)
8. Melo N, Wolff GH, **Costa-da-Silva AL**, Arribas R, Fernandez Triana M, Gugger M, Riffell JA, DeGennaro M, Stensmyr MC. 2019. Geosmin attracts *Aedes aegypti* mosquitoes to oviposition sites. *bioRxiv* 598698. doi: [10.1101/598698](https://doi.org/10.1101/598698)
9. **Costa-da-Silva AL**, Ioshino RS, Araújo HR, Kojin BB, Zannotto PM, Oliveira DB, Melo SR, Durigon EL, Capurro ML. **2017**. Laboratory strains of *Aedes aegypti* are competent to Brazilian Zika virus. *bioRxiv* 2016.08.26.071654; doi: [10.1101/071654](https://doi.org/10.1101/071654)

Book chapters

1. **Costa-da-Silva AL**. **2022**. Artificial membrane feeding mosquitoes in the laboratory with Glytube. In *Cold Spring Harbor Protoc.* Cold Spring Harbor Laboratory Press. doi: [10.1101/pdb.prot108013](https://doi.org/10.1101/pdb.prot108013)
2. **Costa-da-Silva AL**. **2022**. Membrane Feeding Devices to Blood Feed Mosquitoes in the Laboratory. In *Cold Spring Harbor Protoc.* Cold Spring Harbor Laboratory Press. doi: [10.1101/pdb.top107655](https://doi.org/10.1101/pdb.top107655)
3. **Costa-da-Silva AL**, Maciel C, Moreira, LA, Capurro ML. **2012**. Mosquitos Transgênicos para o Controle de Doenças Tropicais – Chapter 18. In *Tópicos Avançados em Entomologia Molecular* : Instituto Nacional de Ciência e Tecnologia em Entomologia Molecular. 2013. 582p. Rio de Janeiro: ISBN 9788591612710, 859161271X. Editors: C. Winter, M. A. C. S. Neto, C. Termignoni. Publisher: Itabajara da Silva Vaz Junior. Weblink: <http://www.inctem.bioqmed.ufrj.br/index.php/pt/biblioteca/124-topicos-avancados-em-entomologia-molecular-instituto-nacional-de-ciencia-e-tecnologia-em-entomologia-molecular>.

Editorially reviewed article

1. Marrero K, **Costa-da-Silva AL**, DeGennaro, M. Female mosquitoes rely on one another to choose the best breeding sites – and with the arrival of spring, they're already on the hunt. *The Conversation US*. 03/19/2024.

Accepted manuscript

1. **Costa-da-Silva AL**, Zhou J, Frederiksen A, Palacios RC, Ramirez Fernandez C, Gonzalez M, Pravia D, Miao L, Dye-Braumuller K, Fridriksson SE, Frick E, Li H, Gunter SM, DeGennaro M, Nolan MS. **2026**.

AeEggCounter: A computer vision tool for high-throughput screening of Aedes eggs from ovitrap field samples. *J Am Mosq Control Assoc* (Accepted: July 18, 2026).

Manuscript under review

1. MacInnis AE, **Costa-da-Silva AL**, Bellantuono AJ, DeGennaro M & Wells JD. **2026**. A genetically marked maggot to better understand corpse decomposition ecology. Research Square <https://doi.org/10.21203/rs.3.rs-9783362/v1>

Manuscripts in preparation

1. Hamerling LW, Wagner-Coello HU, DeGennaro M, **Costa-da-Silva AL**. Community-based ovitrap surveillance reveals seasonal peaks, environmental drivers, and spatiotemporal dynamics of *Aedes aegypti* in Miami-Dade County. *In preparation*.

Invited Talks

1. Webinars of the Latin American Association of Chemical Ecology (ALAEQ). Topic: Chemical Ecology of Vector Insects. Argentina (Remote). Talk: Attractive and repellent social cues are used during mosquito oviposition-site seeking. 10/18/2022.
2. Symposium on Impacts of the New Genome Editing Technique CRISPR-Cas9 on Science and Society. Talk: CRISPR-Cas9 and *Aedes aegypti*. 06/30/2017. University of Sao Paulo, SP. Youtube: <https://www.youtube.com/watch?v=htMY9VhQ-el>.
3. International course of Achievements and challenges for controlling vector-borne diseases in a changing world. Module two – Transgenesis and Paratransgenesis. FIOCRUZ. Talk: The use of transgenic mosquitoes to reduce *Aedes aegypti* population size. 2016.
4. VIII UMC Biology Journey. UMC. Mosquitos Transgênicos: Biotecnologia do Desenvolvimento. 2016.
5. I Workshop of Public Health: Emergent diseases. HOTEK Education Group. Talk: O mosquito *Aedes aegypti* e sua relação com as arboviroses: entendendo o problema. 2016
6. I Symposium of Biology and Pharmacy. UNIFIEO University. Talk: Biotecnologia do desenvolvimento e principais aplicações. 2016
7. I Araguaia Biomedical Congress. Federal University of Mato Grosso. Talk: Vetores transgênicos no controle de *Aedes aegypti*. 2014.
8. V UENF Academic week / XI Academic Biology week. Talk: Mosquitos transgênicos: Biotecnologia do desenvolvimento e principais aplicações. 2013.

Visiting Research Experiences

1. *Ohio State University*, Wooster, USA. Peter Piermarini, Principal Investigator 2017
Collaboration - Arbovirus infection in the Malpighian tubules of mosquitoes (Three weeks stay)
2. *National Health Research Institutes*, Toufen, Taiwan. Chun-Hong Chen, Ph.D. Principal Investigator 2015
Training on CRISPR/Cas9 system in mosquitoes and Seminar Presentation (One month stay)
3. *University of California*, Irvine, USA. Anthony A. James, Ph.D. Principal Investigator 2013
Lab visiting and Seminar Presentation (One week stay)
4. *Yale University*, New Haven, USA. Erol Fikrig, M.D. Principal Investigator 2010
Performing experiments for the Ph.D. thesis and Seminar Presentation (One month stay)

Research/Grants

Internal Grants - Pre-Awarded

1. FIU-RCMI Pilot Grant Program - RCMI RFA-MD-22-002: \$50,000 2026-2027
“Determining the mosquito bite risk of individuals in communities with contrasting arbovirus incidence to prevent transmission in Miami-Dade County”
Full proposal pre-awarded on March 03, 2026
IRB approval letter on May 15, 2026
Officially submitted for NIMHD approval on June 02, 2026
Andre Costa-da-Silva (Principal Investigator)

Submitted Proposals – Pending Review

1. 2026. Florida Department of Agriculture and Consumer Services (FDACS): \$114,461.46 2026-2027
“Enhancing Aedes-specific female mosquito trapping for improved surveillance and arboviral risk prediction”
Andre Costa-da-Silva (Co-Investigator)
2. 2026. National Institutes of Health (NIH) R01 – PA-25-301: \$173,844.56 2026-2028
“tRNA modifications as a critical link between symbionts and mosquitoes that impacts viral transmission”.
Subcontract from University of Cincinnati.
Andre Costa-da-Silva (Co-Investigator)

Externally Funded - In Progress

1. The Centers for Disease Control and Prevention - U01CK000662: \$722,243 2022-2027
“Southeastern Regional Center of Excellence in Vector-Borne Diseases: The Gateway Program”
Subcontract from University of Florida
Andre Costa-da-Silva (Co-Investigator)
2. NIH/NIAID R01 subcontract from University of South Carolina - 1R01AI165560-01: \$789,373 2021-2026
“Next generation mosquito control through technology-driven trap development and artificial Intelligence guided detection of mosquito breeding habitats”

Andre Costa-da-Silva (Co-Principal investigator)

Externally Funded - Concluded

1. National Institute of Justice - 2019-DU-BX-0013: \$279,983 2020-2022
“Germ-Line Transformation of Forensically Important Flies”
Andre Costa-da-Silva (Key Personnel). J. Wells (PI) & M. DeGennaro (PI)

Proposal Not Funded

1. 2026. Puerto Rico Science, Technology, and Research Trust. Request for Proposals: Development of Disposable Capture Chambers, Adhesives, and Attractant Kits for the AGO Trap: \$99,790.05
“Development of Plant-Based Attraction Capsule to Infuse Autocidal Gravid Ovitrap”
Andre Costa-da-Silva (Co-Investigator)
2. 2024. NIH/NIAID R21 Exploratory Grant. Application Identifier: 1792741: \$394,511
“Utilizing human skin commensal communities to understand and reduce mosquito attraction”
Andre Costa-da-Silva (Co-Investigator)
3. 2022. Proposal 2308528. National Science Foundation. Program: Ecology and Evolution of Infectious Diseases (EEID). “Heritable viral signatures in Aedes aegypti genomes and their adaptive role in limiting arboviral transmission”. Submitted: November/2022. Estimated projected cost: \$2,990,350. *Reviewed, not funded.*
Andre Costa-da-Silva (Co-Principal investigator)
4. 2022. Department of Defense - FY23 DWFP Program Pre-Proposal. “Developing a Core Arthropod Low Attraction Microbiome to Protect the Warfighter”. Submitted: December/2022. Estimated projected cost: \$894,000. *Reviewed, not funded.*
Andre Costa-da-Silva (Key Personnel)
5. 2020. Florida Department of Agriculture and Consumer Services (FDACS): \$97,375.67
“Determine whether SAP2-like insecticide resistance mechanisms exist in Aedes aegypti mosquitoes in Florida”
Andre Costa-da-Silva (Co-Principal Investigator)
6. 2018. Florida Department of Agriculture and Consumer Services (FDACS): \$89,439.58
“Mapping Aedes aegypti genetic diversity and population structure across Florida to discover the basis of vector adaption and resistance.”
Andre Costa-da-Silva (Co-Principal Investigator)

Software and Application Development

1. Costa-da-Silva *et al.* AeEggCounter: Web- and mobile-based computer vision tool for high-throughput quantification of Aedes eggs from ovitrap field samples.
Aedes Control through Technology-driven Trapping ACTT Study.
Website: <https://www.acttstudy.org/>

Invited Peer-reviews – Journals

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|--|---|
| 1. Nature Communications | 16. Archives of Microbiology |
| 2. Communications Biology | 17. Journal of Visualized Experiments (JoVE) |
| 3. Scientific Reports | 18. Viruses |
| 4. Pathogens | 19. Journal of the American Mosquito Control Association |
| 5. PLOS Neglected Tropical Diseases | 20. International Journal of Environmental Research and Public Health |
| 6. Parasites & Vectors | 21. Environmental Health Insights |
| 7. PLOS One | 22. Revista Brasileira de Epidemiologia |
| 8. The American Journal of Tropical Medicine and Hygiene | 23. Revista de Patologia Tropical |
| 9. Journal of Vector Ecology | 24. Revista Instituto Medicina Tropical de Sao Paulo |
| 10. Insect Science | 25. Diagnostics |
| 11. Insects | 26. The Open Tropical Medicine Journal |
| 12. Journal of Genetic Engineering and Biotechnology | 27. Journal of Scientific Research and Reports |
| 13. Open Access Insect Physiology | 28. Revista Peruana de Medicina Experimental y Salud Pública |
| 14. Virology Journal | |
| 15. Frontiers in Insect Science | |

Invited Instructor in International Courses

1. Desmistificando la Clonación, bioinformática y banco de datos en Biología Molecular, usando parásitos como modelo. Montevideo, Uruguay. 2014.
2. Second Latin American Biosafety Training Course in Relation to Genetically Modified Vectors for Diseases Control. Lecture: Microinjection of *Aedes aegypti* embryos. Medellín, Colombia. 2010.

Oral Presentation in International Meetings

1. 2024. Entomology. Section: Innovating Vector Control: Techniques and Strategies for Disease Prevention. “Is Miami the epicenter for developing AI technology-driven mosquito surveillance methods?”. Oral presentation. Phoenix, Arizona.
2. 2015. 2nd RCM on Exploring Genetic, Molecular, Mechanical and Behavioral Methods of Sex Separation in Mosquitoes. “Promoting refractoriness in *Aedes aegypti* fed with Dengue virus infected blood.” Oral presentation. Juazeiro, Bahia, Brazil.
3. 2009. EMBO meeting on Vector Biology: Fourth International Meeting on Molecular and Population Biology of Mosquitoes and Other Disease Vectors. “Identification of genes expressed during late oogenesis in *Aedes aegypti*.” Oral presentation. Kolymbari, Greece.

Poster presentation in International Meetings

1. 2016. XXV International Congress of Entomology. Developing a death upon infection system in transgenic *Aedes aegypti* infected with Dengue virus. Orlando, USA.
2. 2013. Gordon Research Conference on Tropical Infectious Diseases. Effects of different anticoagulants on *Aedes aegypti* artificial blood meal and their interferences on Dengue virus infection. Galveston, USA.
3. 2009. Gordon Research Conference on Molecular Approaches For Emergent / Re-Emergent Tropical Diseases. Identification of genes expressed during late oogenesis in *Aedes aegypti*. Galveston, USA.

Attendee in Courses

1. 2025 – FIU-RCMI Proposal Development Workshop Series – Fall 2025 (5 webinars)
2. 2025 – Big Classes, Bigger Connection: Real Engagement in a World of Distractions – 07-02-2025 Center for the Advancement of Teaching - FIU
3. 2025 – FIU Akindi Training webinar – 03-26-2025
4. 2024 – VOCES Inclusive Teaching Summit – 06-2024 (3 days)
5. 2017 – Training course – Fall 2017 Center for Advancement of Teaching (CAT)'s New Faculty Course Design Institute (CDI)
6. 2016 – Training course: Zika virus diagnostic. Sao Paulo, Brazil
7. 2015 – Singapore – International Atomic Energy Agency - Third Country Training Programme. Regional training course on the strategy and evaluation of trials on *Aedes* mosquito population suppression using the sterile insect technique. Singapore
8. 2012 – First Workshop Training in Scientific Publication for Researchers from University of Sao Paulo, Brazil
9. 2009 – First Latin American Biosafety Training Course in Relation to Genetically Modified Vectors for Diseases Control. Medellin, Colombia
10. 2009 – International Course of Insect Vector Interaction with Pathogens Causative Agents of Neglected Diseases. Belo Horizonte, Brazil
11. 2007 – VectorBase platform international course. Attendee. Belo Horizonte, Brazil

Teaching Experience

Teaching Summary

- Taught and coordinated instruction for ~3,000 undergraduate students across lecture and laboratory courses.

- Instructor of record for multi-section Genetics Laboratory; Supervised 18 teaching assistants.
- Developed and implemented active-learning, research-based, and laboratory-integrated curricula across undergraduate courses.

1. Undergraduate Upper-level courses

Florida International University

Instructor - General Biochemistry (BCH3033)

Spring 2024-Present (8 terms)

- Large-enrollment course (140 to 200 students per term)
- Active-learning lecture design and formative assessments (iClicker, short quizzes)
- Interactive in-class activities involving hand-drawing of metabolic pathways
- SPOTs consistently >4.5/5

Instructor - Urban Vector Biology (PCB4403C)

Spring 2026-Present (1 term)

- Developed a course integrating field, laboratory, and active-learning approaches in modern vector biology
- Approved the new laboratory-integrated version of the course
- Students conduct mosquito surveillance, species identification, mosquito dissections and geospatial mapping
- Students develop an Integrated Vector Management (IVM) program and present it in a simulated city council approval meeting

Instructor of Record - Genetics Laboratory (PCB3063L)

Spring 2024-Fall 2025 (6 terms)

- Coordinated 8-16 laboratory sections per term
- Mentored 7-10 teaching assistants weekly
- Integrated field and lab research components
- Redesigned course curriculum to incorporate Course-based Undergraduate Research Experience (CURE) laboratory modules

Instructor - Topics in Physiology/Biochemistry (PCB4717)

Spring 2019-Fall 2021 (9 terms)

(Urban mosquitoes: from their ecology to the modern methods of control)

- Blended course design integrating traditional lectures and flipped classroom instruction
- Students delivered seminars on vector topics, and formative in-class assessments
- Student debates on alternative vector control methods
- In-person and online delivery

2. High School level

Educafro Sao Paulo

Volunteer Biology Teacher

2002 (1 term)

- Preparatory Course for College Entrance Exams

Stimulated and supported students to pursue academic opportunities

Official Student Mentorship

Rafaella Sayuri Ioshino	Ph.D. degree / USP	Official co-advisor	2016-2019
Ana Elice Lopes Fonseca	Undergraduate / USP	Official advisor	2014

Flávia Rosa Navarrete

Undergraduate / USP

Official advisor

2014

Unofficial Student Co-Mentorship

Ashley Muro	Undergraduate / FIU	Lab mentor	2025-Present
Nayred Aguilera	High school intern/ FIU	Lab mentor	Summer 2025
Melissa Gonzalez	Undergraduate / FIU	Lab mentor	2025-Present
Hugo Bravo Gallegos	Ph.D. degree / FIU	Lab mentor	2024-Present
Andre Arce	Ph.D. degree / FIU	Lab mentor	2024-Present
MD Tanzim UI Alam	Ph.D degree / FIU	Lab mentor	2024-Present
Natasha Silva	Undergraduate / FIU	Lab mentor	2023-Present
Daniel Morales	Ph.D. degree / FIU	Lab mentor	2022-Present
Kaylee Marrero	Ph.D. degree / FIU	Lab mentor	2022-Present
Elaine Chu	Ph.D. degree / FIU	Lab mentor	2019-Present
Olayinka David	Ph.D. degree / FIU	Lab mentor	2018-2024
Roberto Palacios	Postbaccalaureate / FIU	Lab mentor	2023-2024
Helen Wagner	Undergraduate / FIU	Lab mentor	2019-2023
Kristian Lopez	Undergraduate / FIU	Lab mentor	2019-2022
Jean Boloix	Undergraduate / FIU	Lab mentor	2018-2020
Silvia Cabal	Undergraduate / FIU	Lab mentor	2018-2020
Grace Muñoz	Undergraduate / FIU	Lab mentor	2017-2018
Robert Arribas	Postbaccalaureate / FIU	Lab mentor	2017-2018
Paola Martinez	Postbaccalaureate / FIU	Lab mentor	2017-2018
Thaís Sobelman	Undergraduate / USP	Lab mentor	2016
Diego Azevedo Soares	Master's degree / USP	Lab mentor	2014
Rafaella Sayuri Ioshino	Master's degree / USP	Lab mentor	2013
Laisa Sentieri Lorenti	Undergraduate / USP	Lab mentor	2011

Evaluation Committees

1. 2026. Invited Committee Member
COSTA-DA-SILVA, A. L. Dissertation Committee Meeting – Summer: Ph.D. Date:05/27/2026
Candidate: Shanjida Afrin. Advisor: Janna Fierst, Florida International University
2. 2026. Oral Presentation Evaluation Committee
COSTA-DA-SILVA, AL. Biomolecules on the Beach – Summer, May 11, University of Miami
3. 2026. Poster Presentation Evaluation Committee
COSTA-DA-SILVA, AL. Biomolecules on the Beach – Summer, May 12, University of Miami
4. 2026. Invited Committee Member
COSTA-DA-SILVA, A. L. Dissertation Committee Meeting – Spring: Ph.D. Date:04/13/2026
Candidate: Florence T. Onifade. Advisor: Janna Fierst, Florida International University

5. 2026. Oral Presentation Evaluation Committee
COSTA-DA-SILVA, AL. Biosymposium – Spring, February 7, Florida International University
6. 2025. Invited Committee Member
COSTA-DA-SILVA, A. L. Proposal defense Committee Meeting – Spring: Ph.D. Date:10/22/2025
Candidate: Hugo Bravo Gallegos. Advisor: Matthew DeGennaro, Florida International University
7. 2025. Invited Committee Member
COSTA-DA-SILVA, A. L. Paper critique Committee Meeting – Spring: Ph.D. Date:03/18/2025
Candidate: Hugo Bravo Gallegos. Advisor: Matthew DeGennaro, Florida International University
8. 2023. Poster Evaluation Committee
COSTA-DA-SILVA, AL. Annual Biomolecular Sciences Institute Research Symposium - Spring, May 9–10, Florida International University
9. 2022. Invited Committee Member
COSTA-DA-SILVA, A. L. Graduate Committee Meeting – Spring: Ph.D. Date:03/14/2022
Candidate: Amber MacInnis. Advisor: Dr. Jeffrey D. Wells, Florida International University
10. 2017. Master's Degree Defense
COSTA-DA-SILVA, A.L; Marrelli, MT; Almeida, F; Câmara, TNO
Candidate: Ramon Wilk da Silva
Master's Student in Public Health – School of Public Health, Universidade de São Paulo.
11. 2015. Master's Degree Qualifying Exam
COSTA-DA-SILVA, AL; Kirchgatter, K.
Candidate: Laura Cristina Multini
Genetic characterization of *Aedes fluviatilis* populations in municipal parks of São Paulo.
Qualifying Exam (Master's in Tropical Medicine) – Institute of Tropical Medicine of São Paulo
12. 2014. Undergraduate Dissertation Defense:
COSTA-DA-SILVA, AL; Duarte, EC
Candidate: Ana Elice Lopes Fonseca.
Bachelor's in Biological Sciences – Centro Universitário Adventista de São Paulo
13. 2013. Master's Degree Qualifying Exam
COSTA-DA-SILVA, AL; Carboni, BSS; Oliveira, CJF
Candidate: Larissa Almeida Martins.
Master's Student in Pathogen-Host Interaction, Institute of Biomedical Sciences, Universidade de São Paulo
14. 2013. Ph.D. Thesis Defense
COSTA-DA-SILVA, A. L.; Marrelli, MT; Galati, EAB; Malafronte, RS; Kuwabara, EF
Candidate: Andre Barreto Bruno Wilke.
School of Public Health, Universidade de São Paulo

Outreach and Youth Engagement

Florida International University

- | | |
|--|-----------------------|
| Instructor – Microinjection workshop (BSC6926-U03) | November 2018-Present |
| <ul style="list-style-type: none"> ○ Created hands-on workshops on insect embryo microinjection techniques ○ Adaptable to undergraduate training and youth outreach programs | |
| Lab Mentor – FIU Summer Research Internship Program | Summer 2025-Present |

- FIU Summer Research Internship Program - South Florida High Schools

Media Coverage, Interviews, and News Articles

1. 2026. Media interview. **Costa-da-Silva AL**, Arce A. PUENTES LATINOS with Jorge Yeshayahu and Monica Guibovich, S1/E43: Dr. Andre Luis and Andrea Arce. Puentes Latinos. YouTube.Link: <https://www.youtube.com/watch?v=OyNdzbq-fvI>
2. 2026. News article. Costa-da-Silva AL, DeGennaro M. *In mosquitos, viruses fight to stand out from the crowd*. FIU News, Science & Technology. 06/16/2026. Written by JoAnn Adkins. Link: <https://news.fiu.edu/2026/in-mosquitos-viruses-fight-to-stand-out-from-the-crowd>
3. 2025. News article. **Costa-da-Silva AL**, DeGennaro M. Florida scientists tackle never-ending mosquito season. Reuters. 11/17/2025. Link: <http://youtube.com/watch?si=JKQ7CMcVVdlB6DRN&v=S0esVPZjW10&feature=youtu.be>
4. 2024. News article. Marrero K, **Costa-da-Silva AL**, DeGennaro M. Female Mosquitoes Follow Each Other to Breeding Sites. Scientific American. 03/20/2024. Link: <https://www.scientificamerican.com/article/female-mosquitoes-follow-each-other-to-breeding-sites/>
5. 2024. News article. **Costa-da-Silva AL**, DeGennaro M. Mosquitoes turn egg-laying into exclusive pool party. FIU News, Science & Technology. 02/08/2024. Written by JoAnn Adkins. Link: <https://news.fiu.edu/2024/mosquitoes-turn-egg-laying-into-exclusive-pool-party>
6. 2023. Interview. **Costa-da-Silva AL**. Scientists learn more about mosquito first spotted in South Florida in 2018. CBS News Miami. 04/20/2023. Link: <https://www.cbsnews.com/miami/video/scientists-learn-more-about-mosquito-first-spotted-in-south-florida-in-2018/>
7. 2017. Interview. **Costa-da-Silva AL**. Proliferation of mosquitoes (Culex) greater than usual in the city of São Paulo. Jovem Pan Radio – Program: Radioatividade. 01/09/2017. Link: <https://www.youtube.com/watch?v=vGF5n-wclvU>
8. 2013. News article. **Costa-da-Silva AL**. Scientists from the Institute of Biomedical Sciences (ICB) develop a low-cost artificial feeder. USP News Agency. 08/26/2013. Link: <https://www5.usp.br/noticias/tecnologia-2/cientistas-do-icb-desenvolvem-alimentador-artificial-de-baixo-custo/>

Fellowships

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| 1. Postdoctoral Fellow by Centers for Disease Control and Prevention (CDC) | 2017-2021 |
| 2. Postdoctoral Fellow funded by CNPq/PNPD/CAPES | 2011-2017 |
| 3. CNPq Doctoral Degree Fellowship Recipient | 2006-2011 |
| 4. CNPq Master's Degree Fellow (Promoted to Direct Doctoral Program) | 2005-2006 |
| 5. Undergraduate Fellow funded by PIBIC/CNPq at UMC | 2003-2004 |

Honors and Awards

1. 1st Place Early Career Oral Presentation Award Winner.
Biomolecules on the Beach, Biomolecular Sciences Institute, Florida International University 2025
2. Top 10% Most Cited Article, *PLOS Neglected Tropical Diseases*, 2020. 2020
Costa-da-Silva AL et al. First report of naturally infected *Aedes aegypti* with chikungunya virus genotype ECSA in the Americas. 2017.
3. Honorable Mention.
VII Undergraduate Research Meeting, University of Mogi das Cruzes 2004

Affiliations

Current

1. Biomolecular Sciences Institute, Department of Biological Sciences, Florida International University
2. Department of Biological Sciences, Florida International University
3. Southeastern Center of Excellence in Vector-Borne Diseases

Previous

1. Department of Parasitology, Institute of Biomedical Sciences, University of Sao Paulo
2. National Institute of Science and Technology in Molecular Entomology (INCT-EM), Brazil
3. Zika-Network from FAPESP funding agency, Sao Paulo

Professional Profiles

1. ORCID: <https://orcid.org/0000-0002-7615-7376>
2. ResearchGate: <https://www.researchgate.net/profile/Andre-Costa-Da-Silva>

References

1. Matthew DeGennaro, Ph.D. Florida International University. E-mail: mdegenna@fiu.edu
2. Bianca Burini Kojin, Ph.D. University of Florida. E-mail: bianca.kojin@ufl.edu
3. Philip K. Stoddard, Ph.D. Florida International University. E-mail: stoddard@fiu.edu
4. Melissa Nolan, Ph.D. University of South Carolina. E-mail: MSNOLAN@mailbox.sc.edu
5. Sarah Gunter, Ph.D. Baylor College of Medicine. E-mail: sarah.gunter@bcm.edu
6. Conor McMeniman, Ph.D. Johns Hopkins Bloomberg School of Public Health. E-mail: cmcmeni1@jhu.edu
7. Peter Piermarini, Ph.D. Ohio State University. E-mail: piermarini.1@osu.edu
8. Margareth Lara Capurro, Ph.D. University of Sao Paulo. E-mail: mcapurro@icb.usp.br

9. Lincoln Suesdek, Ph.D. Butantan Institute. E-mail: lincoln.suesdek@butantan.gov.br
10. Aparecida Sadae Tanaka, Ph.D. Federal University of Sao Paulo. E-mail: tanaka.bioq@epm.br