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### EDUCATION

- 2011 **James Cook University (JCU), Australia**, Ph.D., School of Pharmacy & Molecular Sciences  
Supervisors: Prof. David J. Miller, Dr. Madeleine van Oppen  
Thesis: The Molecular Stress Response in the Indo-Pacific Model Scleractinian Coral:  
*Acropora millepora*
- 2004 **University of Hawaii (UH) at Mānoa**, B.S., Zoology  
Thesis: Abnormal Growth in the Main Hawaiian Reef-Building Coral: *Porites compressa*

### RESEARCH INTERESTS

My main interest as a molecular ecologist is the response of organisms to current climate change and anthropogenic pollution stress. To understand the effects and outcomes resulting from environmental change, I combine transcriptomics, proteomics, enzymatic activity, physiology and ecology to study the role of acclimatization and adaptation in natural populations in both field and lab-based investigations.

Reef-building corals are the foundation taxa of an entire ecosystem and are severely impacted by direct human activity as well as climate change. I use the sensitivity of corals to environmental change to investigate the molecular stress response to predicted future scenarios, allowing an understanding of the genomic components under selection by climate change.

### FELLOWSHIP, GRANTS & AWARDS

- 2008 Prince Albert 1<sup>st</sup> Exceptional Ph.D. Scholarship (25,000 Euros)  
2008 ARC Center of Excellence in Coral Reef Studies Travel Award  
2009 Pacific Science Inter-Congress Travel Award  
2007 – 09 AIMS@JCU Travel Awards  
2006 – 08 AIMS@JCU Research Scholarship (AUS\$ 5,000/yr)  
2006 – 08 AIMS@JCU Tuition Waiver Scholarship  
2005 – 07 Government of Monaco Ph.D. Scholarship (25,000 Euros/yr)

**RESEARCH EXPERIENCE**

- 2013 – **Junior researcher**, Kewalo Marine Laboratories, University of Hawaii  
Proteomics and enzymatic activity of the effects of land-based pollution on coral health  
Mentor: Prof. Robert Richmond
- 2011 – 2013 **Postdoctoral scholar**, Hopkins Marine Station, Stanford University  
Physiology and transcriptomics of coral acclimatization and adaptation to climate change  
Mentor: Prof. Stephen R. Palumbi
- 2005 – 2011 **Ph.D.**, Comparative Genomics Centre, JCU, Australia  
Transcriptomics of the coral stress response to bleaching and pollution stress  
Mentor: Prof. David J. Miller
- 2009 – 2010 **Research assistant**, School of Marine and Tropical Biology, JCU  
Gene expression analysis system on the establishment of coral symbiosis under heat stress  
Mentor: Prof. Bette Willis
- 2009 **Research assistant**, ARC Center of Excellence for Coral Reef Studies, JCU  
Real-time quantitative PCR analysis of the coral bleaching response  
Mentors: Drs. Tracy Ainsworth and Bill Leggat
- 2008 **Research assistant**, Australian Institute of Marine Science  
Coral antioxidant gene expression under heat stress  
Mentor: Dr. Madeleine van Oppen
- 2004 – 2005 **Research intern**, Scientific Centre of Monaco  
Molecular techniques applied to cnidarians  
Mentor: Dr. Didier Zoccola
- 2003 – 2004 **Research assistant**, Hawaiian Institute of Marine Biology, UH  
Techniques in coral propagation and monitoring of fecundity  
Mentor: Ass. Prof. Cindy Hunter
- 2002 **Laboratory assistant**, Kewalo Marine Laboratory, UH  
Multiple tasks in varying projects on tree snails, nudibranchs, corals, barnacles, & biofouling  
Mentors: Prof. Mike Hadfield, and Dr. Brenden Holland

## REFEREED PUBLICATIONS

## 2013

Raina J-B, Tapiolas DM, Foret S, Lutz A, Abrego D, Ceh J, **Seneca FO**, Clode PL, Bourne DG, Willis BL, Motti CA (2013) **DMSP biosynthesis by an animal and its role in coral thermal stress response**. *Nature*, 502: 677-680. doi:10.1038/nature12677.

**[Press coverage by Nature Asia, Nature World News, Science Daily, Phys.org, Life sciences world, and more.]**

Tolleteer D<sup>#</sup>, **Seneca F<sup>#</sup>**, DeNofrio JC, Palumbi SR, Pringle JR, Grossman AR. (2013) **Coral bleaching independent of photosynthetic activity**. *Current Biology*, 23: 1782-1786. (Cover)

<sup>#</sup>These authors contributed equally.

**[Press coverage by Science Daily, Wildlife Disease News Digest, Health Advisor.]**

Barshis DJ, Ladner JT, Oliver TA, **Seneca FO**, Traylor-Knowles N and Palumbi SR. (2013) **A genomic basis for coral resilience to climate change**. *Proceedings of the National Academy of Sciences*, 110(4): 1387-1392. (Cover)

**[Press coverage by Nature, Science, The Washington Post, Mother Jones, Consortium for Ocean Leadership, and more.]**

## 2012

De Wit P, Pespeni MH, Ladner JT, Barshis DJ, **Seneca F**, Jaris H, Overgaard Therkildsen N, Morikawa M, Palumbi SR. (2012) **The simple fool's guide to population genomics via RNA-Seq: an introduction to high-throughput sequencing data analysis**. *Molecular Ecology Resources*, 12(6): 1058-67. doi: 10.1111/1755-0998.12003.

Siboni N, Abrego D, **Seneca F**, Motti CA, Andreakis N, et al. (2012) **Using bacterial extract along with differential gene expression in *Acropora millepora* larvae to decouple the processes of attachment and metamorphosis**. *PLoS ONE*, 7(5): e37774. doi:10.1371/journal.pone.0037774.

Puill-Stephan E, **Seneca FO**, Miller DJ, van Oppen MJH, Willis BL (2012) **Expression of putative immune response genes during early ontogeny in the coral *Acropora millepora***. *PLoS ONE*, 7(7): e39099. doi:10.1371/journal.pone.0039099.

## 2011

Ainsworth TD, Wasmund K, Ukani L, **Seneca F**, Yellowlees D, Miller D, and Leggat W (2011) **Defining the tipping point: A complex cellular life/death balance in corals in response to stress**. *Scientific Reports*, 1:160 DOI: 10.1038/srep00160.

Leggat WP, **Seneca F**, Wasmund K, Ukani L, Yellowlees D, Ainsworth TD. (2011) **Differential responses of the coral host and their algal symbiont to thermal stress**. *PLoS ONE*, 6(10): e26687.

Forêt S<sup>#</sup>, **Seneca F<sup>#</sup>**, de Jong D, Bieller A, Hemmrich G, Augustin R, Hayward DC, Ball EE, Bosch TCG, Agata K, Hassel M and Miller DJ (2011) **Phylogenomics reveals an anomalous distribution of USP genes in metazoans**. *Molecular Biology and Evolution*, 28(1): 153-161. <sup>#</sup>These authors contributed equally.

Souter P<sup>#</sup>, Bay LK<sup>#</sup>, Andreakis N<sup>#</sup>, Császár N, **Seneca F** and van Oppen MJH. (2011) **A multi-locus, temperature stress related gene expression profile assay in *Acropora millepora*, a dominant reef-building coral.** *Molecular Ecology Resources*, 11: 328-334. <sup>#</sup>These authors contributed equally.

## 2010

**Seneca F**, Forêt S, Ball E, Smith-Keune C, Miller D J and van Oppen M. (2010) **Patterns of Gene expression in a Scleractinian coral undergoing natural bleaching.** *Marine Biotechnology*, 12(5): 594-604.

## 2009

Császár N, **Seneca F**, and van Oppen M. (2009) **Variation in expression levels of antioxidant genes in the scleractinian coral *Acropora millepora* under laboratory thermal stress conditions.** *Marine Ecology Progress Series*, 392: 93-102.

Bay L, Nielsen B, Jarmer H, **Seneca F**, van Oppen M. (2009) **Transcriptomic variation in a coral reveals pathways of clonal organization.** *Marine Genomics*, 2: 119-125.

## PUBLICATIONS IN PREPARATION

**Seneca F**, Palumbi S. (In prep) The role of acclimatization and adaptation in the bleaching response of resilient corals.

**Seneca F**, Palumbi S. (In prep) Early and repeated time points following heat stress reveal mechanisms versus consequences of coral bleaching.

**Seneca F**, Barshis D, Palumbi S. (In prep) Apoptosis control of coral bleaching is not a general phenomenon.

Ainsworth TD, Knack B, Ukani L, **Seneca F**, Weiss Y, Leggat WP & Miller D. (In prep) Cell and tissue specific gene expression patterns associated with the coral disease 'white syndrome'. PLoSOne.

## ONGOING RESEARCH

**Seneca F**, Forêt S, Goffard N, Smith C, Grasso L, Hayward D, Saint R, van Oppen M, Ball E and Miller D J. (In prep) Extensive coral transcriptome changes occur *in situ* weeks before visual observation of bleaching.

**Seneca F**, Goffard N, Bay L, Peplow L, van Oppen M, and Negri A. (In prep) Differential transcriptomic responses in *Acropora millepora* larvae exposed to tributyltin, copper and temperature.

**Seneca F**, vanOppen M, Willis B. (In prep) The effect of elevated temperature on the innate immunity response during the onset of symbiosis in scleractinian coral larvae.

**Seneca F**, vanOppen M, Willis B. (In prep) Patterns of gene expression involved in the mechanisms of the establishment of coral-algae symbiosis in *Acropora millepora* larvae.

## TEACHING EXPERIENCE

### Course development and instruction

- 2012 Bioinformatics for RNASeq data, Pan-Pacific Advanced Studies Institute, Dumaguete, Philippines
- 2012 Population genomics using next-generation sequencing, Intensive graduate course, Stanford University, USA

### Laboratory training

- 2010 Lubna Ukani, qRT-PCR, ARC Centre of Excellence for Coral Reef Studies, AUS
- 2009 Jeroen Van De Water, Nachshon Siboni, Adrian Lutz, Gene Analysis System, AIMS, AUS
- 2008 Eneour Puill-Stephan, qRT-PCR, AIMS, AUS
- 2007 Nikolaus Csaszar, qRT-PCR, AIMS, AUS
- 2006 Line Bay, cDNA microarray, Australian Institute of Marine Science (AIMS), Townsville, Australia

### Teaching assistant

- 2007 Coral Biology, James Cook University, Townsville, Australia
- 2003 Biology 101, University of Hawaii, USA
- 1999 Botany, Field science educator, Nice, France

## ACADEMIC SERVICES

**Reviewing for:** PLOS One, BMC Genomics, Journal of Experimental Biology, Marine Biology

**Society memberships and volunteering:** International Society for Reef Studies, Society for Advancement of Chicanos and Native Americans in Science (Mentor)

## SCIENCE COMMUNICATION

### Invited

- 2012 Genomic Applications to Marine Science and Resource Management in SE Asia Workshop, Pan-Pacific Advanced Studies Institute, Dumaguete, Philippines
- 2007 Development of coral specific internal control genes for quantitative real time PCR experiment. In: The 1<sup>st</sup> Symbiosis Cell biology Workshop, Heron Island, Australia.

### Contributed

- 2013 3<sup>rd</sup> Annual Yosemite Symbiosis Workshop, Sierra Nevada Research Institute, Wawona, USA.
- 2012 Environmental Biomechanics, Physiology, and Genomics of Marine Species, PISCO at Hopkins Marine Station, Pacific Grove, USA.
- 2010 'Talking science with the media' Workshop, ARC Centre of Excellence for Coral Reef Studies, Brisbane, Australia.

**Presented**

- 2012 Seneca F, Tolleter D, Barshis D, Grossman A, Palumbi S. **Caspase-controlled coral bleaching: is it common?** In: The 12<sup>th</sup> International Coral Reef Symposium, Cairns, Australia.
- 2009 Seneca F, Foret S, Goffard N, Smith C, Grasso L, Hayward D, Saint R, van Oppen M, Ball E and Miller D J. **An Ecological Microarray Study of Coral Bleaching.** In: The 11<sup>th</sup> Pacific Science Inter-Congress, Tahiti, French Polynesia.
- 2008 Seneca F, Foret S, Goffard N, Smith C, Grasso L, Hayward D, Saint R, van Oppen M, Ball E and Miller D J. **An Ecological Microarray Study of Coral Bleaching.** In: the 11<sup>th</sup> International Coral Reef Symposium, Fort Lauderdale, USA.
- 2006 Seneca F, van Oppen M and Miller D J. **Microarray analysis of gene expression in *Acropora millepora* during a natural bleaching event.** In: the Australian Coral Reef Society 82<sup>nd</sup> Annual Conference, Mission Beach, Australia.

**PROFESSIONAL SKILLS AND EXPERIENCE**

**Molecular Biology:** DNA/RNA/protein extraction; cDNA synthesis; PCR, RACE-PCR, qRT-PCR; microarray; GeXP; RNA-Seq; *in situ* hybridization; Western Bolt; enzymatic activity; spectrophotometry; cloning; denaturing gradient-gel electrophoresis

**Cellular Biology:** Microscopy (fluorescent); histology; cell isolation; cell count (flow cytometry)

**Physiology:** Photosynthesis efficiency (PAM); respirometry (oxygraphy); linear, surface and buoyant weight growth; pigment extraction

**Marine Husbandry:** *Symbiodinium*, anemone, and coral propagation techniques; coral spawning; coral and coral larvae rearing; zoo- and phytoplankton culture; aquaria design, maintenance and plumbing

**Computer Skills:** Bioinformatics; Python and regular expression scripting; various R packages; PC and Mac, including word processing and graphics; Adobe Illustrator and Photoshop; Microsoft Office

**Fieldwork:** Scientific diving (UH, JCU, Stanford, PADI Assistant Instructor, NITROX, Rescue Diver); sample collection; GPS; marine invertebrate species identification; benthic survey; mapping; underwater photography and videography; extensive boat handling

**REFERENCES**

Professor Robert Richmond (Junior researcher supervisor/Current employer)

Director of Kewalo Marine Station, University of Hawaii, Honolulu, Hawaii 96813, USA

Phone: (1-808) 539-7300

Email: [richmond@hawaii.edu](mailto:richmond@hawaii.edu)

Professor Stephen Palumbi (Postdoc supervisor/Recent employer/collaborator)

Director of Hopkins Marine Station, Stanford University, Pacific Grove CA 93950, USA

Phone: (1-831) 655-6214

Email: [spalumbi@stanford.edu](mailto:spalumbi@stanford.edu)

Professor Bette Willis (Former employer/collaborator)

Professor, School of Marine & Tropical Biology, James Cook University, Townsville QLD 4811, Australia

Phone: (61-7) 4781-5349 / Fax: (61-7) 4725-1570

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Dr. Madeleine van Oppen (Associate PhD supervisor/Former employer/Collaborator)

Principal Research Scientist, Australian Institute of Marine Science,

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