



## Amin Roushdy Mohamed

PhD Candidate  
Coral Genomics Group  
ARC Centre of Excellence for Coral Reef Studies  
Department of Molecular and Cell Biology  
Comparative Genomics Centre  
AIMS@JCU  
James Cook University  
and  
Australian Institute of Marine Science (AIMS)

Email: amin.mohamedesmail@my.jcu.edu.au/ am\_rd85@yahoo.com  
Mobile: +61416240442; Office: +6174781-15395; Skype: amin\_roushdy85  
<http://www.coralcoe.org.au/students/amin-mohamed-esmail>  
1 James Cook Dr, James Cook University, Douglas Campus 4811  
Townsville, Queensland, Australia

### RESEARCH INTERESTS

Molecular Biology, Genomics, Transcriptomics, Bioinformatics, Marine Microbial Ecology, coral reefs, coral health and diseases, coral-microbes interactions, and coral-algal symbioses

### EDUCATION

#### **PhD in Coral Reef Genomics**

James Cook University, Australia

May 2012- Expected 2016

Primary advisor: Prof David Miller

Co-advisors: Prof Bette Willis and Dr David Bourne (AIMS)

Thesis title: Coral-algal symbioses: New insights into a photosynthetic apicomplexan-related alga and its interaction with reef corals. A functional genomics approach

#### **PhD Internship in Bioinformatics**

Institute for Molecular Bioscience (IMB) of the University of Queensland (UQ), Australia

September/ October 2014

Bioinformatics and computational systems biology training within the computational systems biology group led by Prof Mark Ragan at IMB, UQ. Training on analysis of next gen sequencing (NGS) datasets including; using the command line to perform bioinformatics analyses, raw data quality control (QC), *de novo* transcriptome sequencing and assembly, transcriptome/genome annotations, mapping NGS data onto reference genome and/or transcriptome, and whole transcriptome analysis.

#### **MSc in Marine Biology**

Benha University, Egypt

2008-2011

Major: Marine Biology

Main supervisor: A. Prof Hany A Abdel-Salam

Thesis title: Distribution and prevalence of coral diseases in some locations along the Red Sea coast in Egypt

#### **BSc in Zoology**

Benha University, Egypt

2002-2006

Major: Biological Sciences

Minor: Zoology, Grade: Excellent with honors; Top person graduated

## WORK EXPERIENCE

### PhD Candidate: 2012-

#### **ARC Centre of Excellence for Coral Reef Studies at James Cook University, Australia**

I have been studying for my PhD degree at JCU and working closely with Prof David Miller who is my PhD main advisor. My PhD is focused on using genomics tools and applying RNA-seq to study onset and establishment of coral-*Symbiodinium* symbiosis. I am also investigating the poorly understood symbiosis between corals and the newly discovered microalga, *Chromera velia* using functional genomics. The work involves also construction of *de novo* transcriptome assembly, comparative transcriptomics of two *Chromera* strains, whole transcriptome analysis of *Chromera* cultures under different growth conditions, and finally investigating the interaction between these algae and corals using RNAseq for the first time.

### Teaching Assistant/ Assistant lecturer: 2006- 2011

#### **Zoology Department, Faculty of Science, Benha University, Egypt**

Teaching different courses to undergraduate students in Zoology and Biotechnology departments and doing research in the field of coral reef ecology in the Red Sea towards MSc degree. During this period, I did a project that provided baseline data on coral diseases and signs of compromised health affecting corals in this region. The work resulted in publishing papers in both local journals and international proceedings.

## PHD RESEARCH PROJECTS:

Projects Funding: Egyptian PhD scholarship, James Cook University Postgraduate Research Scholarship (JCUPRS), AIMS@JCU Top-Up scholarship, and ARC CoE Coral Reef Studies research grant to Prof David Miller.

#### Collaborators:

- Prof Saki Saki Harii, University of Ryukyus, Okinawa
- Prof Noriyuki Satoh and Dr Chuya Shinzato at the Okinawa Institute of Science and Technology (OIST), Okinawa
- Prof Mark Ragan and Dr Cheong X. Chan at the Institute for Molecular Bioscience (IMB), The University of Queensland (UQ) Australia

Responsibilities: I was responsible for experimental design, fieldwork, molecular lab work, NGS data (bioinformatics) analysis, statistical analysis, and manuscript writing in each of the following projects.

#### ***PhD project I: Coral Host Transcriptome Analysis Upon Symbiosis Establishment***

Status: Paper has been published in Molecular Ecology

Project Summary: Microarray-based analyses pointed to the conclusion that host gene expression is largely unresponsive during the establishment of symbiosis. To better understand the early events occurring during the establishment of symbiosis, infection experiments were conducted during spawning in Sesoko Island, Okinawa, Japan in June 2013 using *Acropora digitifera* larvae and a competent strain of symbionts. Illumina RNA-seq was used for the first time to follow coral transcriptome-wide gene expression after exposure to competent *Symbiodinium* at 4, 12 and 48 h post infection. The use of Illumina RNA-seq technology allowed detection of a transient period of differential expression 4 h after the exposure of coral larvae to a competent *Symbiodinium*. This phenomenon has not previously been detected as a consequence of both the lower sensitivity of the

microarray approaches used and the sampling times used. The transcriptomic data present novel insights about the mechanisms underlying establishment of coral-*Symbiodinium* symbiosis.

**PhD project II: Genomic basis of coral-*Chromera* interactions**

Status: Paper manuscript is currently under revision and will be submitted for publication

Summary: Corals live in close associations with large, diverse and specific populations of microorganisms collectively referred to as the coral holobiont. Recently it has been established that a number of alveolates are intimately associated with corals including: the newly discovered alga *Chromera*. Currently, there is a great deal of interest in *Chromera* because it is thought to be the missing link between the photosynthetic dinoflagellates and the non-photosynthetic apicomplexans. Interestingly, all the members of the Apicomplexa are, so far, identified as parasitic organisms. Although the literature implies that *Chromera* is a coral symbiont, this hypothesis has not been rigorously tested; its close relationship to apicomplexans suggests that it might be a facultative parasite. The research project aims to establish the nature of the relationship between *Chromera* and corals by investigating its impact on coral fitness using molecular-based approaches. Stress and immune challenges have distinct transcriptomic signatures, as does the competent *Symbiodinium* infection process. Hence analysis of the transcriptomic impact of *Chromera* infection should shed some light on the nature of the association of this organism with corals.

**PhD project III: Deciphering coral-*Chromera* symbiosis using comparative transcriptomics**

Status: Paper manuscript is under revision and will be submitted for publication

Summary: Since the discovery of *Chromera*, a novel microalga in 2008 during a study of Australian coral symbionts, great interest in this new algal species has developed. *Chromera* has been detected and isolated from different scleractinian corals in Australia including corals of the Great Barrier Reef. However little is known about the ecology and genetics of this microorganism. The study aims to use next generation sequencing technology to generate a reference transcriptome assembly of *Chromera* isolated from *Montipora digitata* at the GBR. Differential gene expression in altered experimental treatments is investigating the diversity and dynamics of *Chromera* transcripts (mRNAs). Cultures were subjected to different culturing conditions (heat stress, cold stress, darkness and motile stages) along with control cultures grown under normal conditions. Analysis of the *Chromera* transcriptome will provide genomic insight into this novel chromerid alga through identifying genes involved in various physiological and metabolic processes. Comparative transcriptomics approach was used in order to identify orthologs and test for selection in the two *Chromera* strains isolated from different coral hosts at distinct locations in Australia. *Chromera* data were also compared with *Symbiodinium* and *Plasmodium* whole genome and/or transcriptome datasets in order to determine shared genes likely involved in symbiosis.

**ONGOING RESEARCH PROJECTS**

Follow-up research from the PhD work

**I - RESEARCH BASED ON CHROMERA TRANSCRIPTOMICS**

The availability of a *de novo* transcriptome for *Chromera* allowed examining large-scale or (transcriptome-wide) responses of *Chromera* to different conditions

**1- *Chromera* transcriptome-wide gene expression under mixotrophic condition**

A mixotrophic culturing strategy was applied to *Chromera* and RNA-Seq was used in order to examine *Chromera* responses in a mixotrophic condition

**2- *Chromera* transcriptome-wide gene expression under thermal stress**

It has been showed that *Chromera* showed more thermal tolerance than *Symbiodinium* (clade B) in cultures. In order to understand the molecular basis its thermal resistance, *Chromera* cultures were subjected to both heat stress and shock.

## II- COLLABORATION WITH AUSTRALIAN INSTITUTE OF MARINE SCIENCE (AIMS)

Dr David Bourne and Dr Andrew Negri

**1- Transcriptomics of coral-*Symbiodinium* symbiosis using *Acropora millepora* and *A. tenuis* and *Symbiodinium* clade C1 strain**

Illumina RNA-Seq will be used to quantify the genome-wide changes during the infection process. Experiments were conducted during coral spawning in the GBR in November 2014 using *A. millepora* and *A. tenuis* larvae and *Symbiodinium* sp. clade C1. Larvae were sampled at four different time points. High quality RNA was isolated and sequenced using the Illumina HiSeq 2000 platform. RNA-Seq data are under analysis.

**2- Transcriptomics of coral-*Chromera* symbiosis using *Acropora millepora* and *A. tenuis* and a *Chromera* strain isolated from the GRB**

Illumina RNA-Seq will be used to quantify the genome-wide changes during the infecting process. Experiments were conducted during coral spawning in the GBR in November 2014 using larvae of *A. tenuis* and *A. millepora*. Larvae were sampled at four different time points. High quality RNA was isolated and sequenced using the Illumina HiSeq 2000 platform. RNA-Seq data are under analysis.

## PUBLICATIONS IN PREPARATION FOR PEER REVIEW IN 2016 (6):

1. **Amin R Mohamed**, Vivian Cumbo, Chuya Shinzato, Cheong Chan, Mark Ragan, Nori Satoh, David J Miller (**under revision**) Coral transcriptome profiling during *Chromera velia* infection provides insights into host-parasites interactions.
2. **Amin R Mohamed**, Cheong Chan, Mark Ragan, David J Miller (**under revision**) Deciphering coral-*Chromera* symbiosis using comparative transcriptomics.
3. **Amin R Mohamed** and David J Miller (**in prep**) *Chromera velia* genome-wide responses to mixotrophic culture and heat stress conditions.
4. **Amin R Mohamed**, Vivian Cumbo, Chuya Shinzato, Nori Satoh, David J Miller (**in prep**) Coral transcriptome profiling during mixed *Chromera* and *Symbiodinium* infection.
5. **Amin R Mohamed** and David J Miller (**review in prep**) Host-parasite interactions: Lessons from the mother of all parasites, *Chromera* and its interactions with reef-corals.
6. **Amin R Mohamed** (**review in prep**) Coral Diseases on Reefs of the Red Sea. Invited from the Saudi Geological Survey (SGS) to be included as a chapter in the new Red Sea book, volume II. Springer. Book editor Dr Najeeb Rasul, SGS technical advisor [najeeb\\_rasul@hotmail.com](mailto:najeeb_rasul@hotmail.com)

## PUBLISHED PAPERS:

1. **Mohamed, A.R.**, Cumbo, V., Harii, S., Shinzato, C., Chan, C.X., Ragan, M.A., Bourne, D.G., Willis, B.L., Ball, E.E., Satoh, N. and Miller, D.J. (2016). The transcriptomic response of the coral *Acropora digitifera* to a competent *Symbiodinium* strain: the symbiosome as an arrested early phagosome. *Molecular Ecology*. doi:10.1111/mec.13659  
<http://onlinelibrary.wiley.com/doi/10.1111/mec.13659/abstract>
2. **Amin R Mohamed**, Abdel-Hamid A.M. Ali, Hany A. Abdel-Salam (2012) Status of coral reef health in the northern Red Sea, Egypt. In: Yellowless D, Hughes TP (eds) Proceedings of the 12th International Coral Reef Symposium, Cairns, Australia, 9-13 July 2012. 9A Coral bleaching and climate change. James Cook University, Townsville

[http://www.icrs2012.com/proceedings/manuscripts/ICRS2012\\_9A\\_8.pdf](http://www.icrs2012.com/proceedings/manuscripts/ICRS2012_9A_8.pdf)

3. **Amin R Mohamed** and Hany A Abdel-Salam (2012) Coral Health and Disease in the Red Sea, Egypt. Lambert Academic Publishing (LAP), Germany, ISBN: 978-3848449620  
<http://www.amazon.com/Coral-Health-Disease-Red-Egypt/dp/3848449625>
4. Hany, A. Abdel-Salam, Abdel-Hamid, A. M Ali, **Amin, R. M. Ismail** (2010) Hurghada coral diseases; are they due to the impacts of global warming or mass tourism? Egypt. Acad. J. biolog. Sci., 2 (2): 33- 46.
5. Abdel-Salam, H.A.; Ali, A.A.M. and **Mohamed, A. R.** (2010) Coral diseases prevalence in El-Ain Al-Sukhna area, Red Sea, Egypt. Proceedings of the 6th International Conference on Biological Sciences, Tanta University, Egypt.

#### TALKS AND CONFERENCE PRESENTATIONS

1. Molecular mechanisms underlying establishment of coral-*Symbiodinium* symbiosis: a transcriptomic approach. Accepted abstract (oral talk) at the 13<sup>th</sup> International Coral Reef Symposium (ICRS) to be held in Hawai'i 19-24 June 2016
2. Coral Diseases on reefs of the Red Sea. Poster presentation at the Red Sea book workshop held at the Saudi Geological Survey in Jeddah Feb. 2016
3. AIMS@JCU Seminar Day 2015: Host transcriptome analysis during establishment of coral-algal symbiosis. Oral presentation
4. AIMS@JCU Seminar Day 2014: *Chromera velia* Transcriptome Analysis. Poster Presentation
5. AIMS@JCU Seminar Day 2013. *Chromera velia*; coral symbiont or parasite? Poster presentation
6. Status of coral reef health in the northern Red Sea, Egypt. 15 min talk at the International Coral Reef Symposium ICRS 8<sup>th</sup> July, 2012 in Cairns, Queensland, Australia
7. Coral diseases and bleaching in Hurghada, Red Sea. 20 min talk at the first International Conference of Biological Sciences, 10<sup>th</sup> June, 2010, Ain Shams University, Egypt
8. Prevalence of coral diseases in El-Ain Al-Sukhna, northern Red Sea, Egypt. 15 min talk at the 6<sup>th</sup> International Conference on Biological Sciences Tanta University, Egypt in 2010

#### GRANTS, PRIZES AND AWARDS

- 2015 AUD 1200: AIMS@JCU Seminar Oral Presentation Award towards science communications
- 2014 James Cook University Postgraduate Research Scholarship (JCUPRS)
- 2014 AIMS@JCU top-up scholarship
- 2014 AUD 750; AIMS@JCU Student Travel Award towards science communications in Australia
- 2013 AUD 1,000; AIMS@JCU seminar Best Poster Award towards science communications
- 2012/13 Achieving highest scores in Molecular Genetics and Genomics subjects at JCU
- 2013 Grant from the ARC Centre of Excellence for Coral Reef Studies towards travel and field work from 20<sup>th</sup> July to 15<sup>th</sup> August in the Sesoko research station, University of the Ryukyus, Okinawa, Japan
- 2012 Travel grant from the ARC Centre of Excellence for Coral Reef Studies to attend the International Coral Reef Symposium ICRS 9th-13th July 2012 in Cairns, Australia

- 2012 PhD scholarship from the Ministry of Higher education and research, Egypt
- 2006 BSc Honours Award; Top person award graduated from Faculty of Science, Benha University, Egypt in 2006

## COURSES AND LICENSES

- Molecular Genetics (BC2023) High distinction and achieving the highest grade JCU in 2012
- Genes, genomes, and development (BC3101) High distinction and achieving the highest grade JCU in 2013
- PADI Open Water Diver Course in Hurghada, Red Sea in 2010
- PADI Advanced Open Water Diver Course in Hurghada, Red Sea in 2011
- PADI Emergency Oxygen Provider 2012, 2013, 2015
- PADI First aid and CPR 2012, 2015
- PADI Rescue diver Course, Queensland, License 1301AF5163, in 2013
- Marine Radio Operator's Certificate of Proficiency (MROCP) Australian Maritime College, License OMC 059190 in 2013
- Marine License Indicator (North Queensland Maritime) License 107513581 in 2013
- Skills for International Postgraduate students (SKIP) course (JCU)
- Post Entry Language Assessment (PELA) test at JCU in 2013
- Academic IELTS overall score 7 in 2011
- General training IELTS overall score 7.5 in 2014

## SOME RESEARCH SKILLS

- PADI open water/ advanced in 2009/10, PADI rescue diver in 2012
- Scleractinian corals taxonomy and identification to the genus/species level in the Red Sea
- Coral reef health assessment and coral diseases ID in the Red Sea, Egypt
- Field work in marine stations at Heron and Orpheus Islands in Australia
- Collecting marine (coral) samples for microbiology and molecular biology work
- Isolating fresh algal symbionts from coral tissues and maintain their growth in liquid cultures
- Coral spawning, larvae rearing and field experiments
- Using different microscopes (light and fluorescent microscopy)
- gDNA and total RNA extractions from adult coral tissues
- gDNA, total RNA, messenger RNA extractions and complementary DNA (cDNA) from coral larvae
- RNA quality control Total RNA quality control through RNA gel electrophoresis, Nanodrop and Qubit fluorometer
- Preparation of DNA and RNA for sending to high throughput sequencing facilities
- Gel electrophoresis and denaturing gradient gel electrophoresis (DGGE) and restriction fragment length polymorphism (RFLP)
- Using different Polymerase chain reactions (PCR) such as: real time qPCR, and TD-PCR including primer design and optimization of the reactions
- Genome-wide gene expression using illumina RNA-Seq
- Illumina raw data processing, quality control and transcriptomic/ genomic analysis
- Using the command line confidently in order to install softwares, perform bioinformatics analyses and query large nucleic acids/proteins sequences against databases

- Confident usage of Unix Shell and high performance computing (HPC) to analyze, store and manage large NGS datasets
- Confident using of SPSS and R programming for statistical analyses
- Working knowledge of perl and python scripting to create custom scripts to query and analyze large sequence databases and transcriptome/genome datasets
- Confident usage of CLC Genomics Workbench, Blast2GO, Galaxy, and DAVID softwares for bioinformatics analyses
- Transcriptome *de novo* sequencing, assembly and full annotations
- Mapping NGS reads onto reference transcriptome and/or genome reference datasets
- Differential gene expression analysis using different R packages (edgeR, DESeq, etc.)
- Gene Ontology (GO) and metabolic KEGG pathways enrichment analyses
- Comparative transcriptomic analyses

#### GENOMICS/ BIOINFORMATICS TRAINING

1. 3 days workshop in Ecological Genomics in 2013, Prof Mikhail Matz at AIMS
2. PhD Internship at the computational biology group at the Institute of Molecular Biosciences (IMB), the university of Queensland (UQ) in 2014
3. Genomics@JCU 2 days workshop 2014: Transcriptome and small genome sequencing and assembly
4. Genomics@JCU 2 days workshop 2014: Whole metagenome analysis and 16S/18S metagenomics
5. Genomics@JCU 1 days workshop 2015: bioinformatics with CLC genomics workbench
6. Genomics@JCU 2 days workshop 2015: Quantitative and Adaptation Genomics in natural and breeding populations
7. R programming language 2 weeks course. Prof Murray Logan at AIMS in 2014

#### PROFESSIONAL MEMBERSHIP

1. Australian Institute of Marine Science @James Cook University (AIMS@JCU)
2. ARC Centre of Excellence for Coral Reef Studies
3. Comparative Genomics Centre (CGC) at JCU
4. International Symbiosis of Microbial Ecology (ISME)
5. Australian Coral Reef Society (ACRS)
6. International Society for Reef Studies (ISRS)
7. Australian Marine Science Association (AMSA)

#### REFREES

**Prof David J. Miller**

Professor of Molecular Genetics  
ARC Centre of Excellence for Coral Reef Studies  
Department of Molecular and Cell Biology  
James Cook University, Townsville, QLD, Australia  
Telephone: +61 7 4781 4373  
Email: [david.miller@jcu.edu.au](mailto:david.miller@jcu.edu.au)

**Prof Bette L. Willis**

Professor of Marine Biology  
ARC Centre of Excellence for Coral Reef Studies  
College of Marine & Environmental Sciences  
James Cook University, Townsville, QLD, Australia  
Telephone: +61 7 478 15349 and +61 7 478 15731  
Email: [bette.willis@jcu.edu.au](mailto:bette.willis@jcu.edu.au)

**Dr David G. Bourne**

Senior research scientist  
Australian Institute of Marine Science (AIMS)  
PMB No.3 Townsville Mail Centre Q 4810  
Telephone: (07) 4753 4139 -Int: +61-7-4753 4139  
Email: [d.bourne@aims.gov.au](mailto:d.bourne@aims.gov.au)

**Prof Mark A. Ragan**

Professor of Computational Systems Biology  
Co-head, Genomics of Development and Disease Division  
Institute of Molecular Bioscience  
University of Queensland, QLD, Australia  
Telephone: +61 7 3346 2616  
Email: [m.ragan@imb.uq.edu.au](mailto:m.ragan@imb.uq.edu.au)

**Dr Cheong Xin Chan**

Senior Research Officer  
Genomics of Development and Disease Division  
Institute for Molecular Bioscience  
University of Queensland, QLD, Australia  
Email: [c.chan1@uq.edu.au](mailto:c.chan1@uq.edu.au)

*Amin R. Mohamed*  
*Last update: April 25<sup>th</sup>, 2016*