

**OCSC 4945 Practical Approaches in Molecular Marine Sciences****Instructor**

Dr. Javier Santander, Department of Ocean Sciences.

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Office hours in-person: Dep. Ocean Sciences, AX3005. Open office hours and upon request. Every effort will be made to respond to emails within 24 h, with the exceptions of evenings, weekends and holidays.

**Co-Instructors**

Dr. Vimbie Machimbirike, Ocean Science Centre

Dr. Surendra Kumar,

Dr. Albert Caballero-Solaris, Ocean Science Centre

**Teaching Assistant**

Ahmed Hossain PhD(c), Marine Biology, Ocean Science Centre

Duglas Sathees MSc(c), Aquaculture, Ocean Science Centre

Ignacio Vasquez PhD(c), Biology, Ocean Science Centre

Camilo Suarez MSc, Ocean Science Centre

**May 08 – May 19: 9:30-4:30 PM**

**Challenge Room and OCSC3012, Department of Ocean Sciences**

**OCSC 4945 Practical Approaches in Molecular Marine Sciences.** This course is a hands-on course focusing on molecular techniques applied to the study of marine life. This course is intended to be broad in scope, touching on aspects of fundamental marine molecular biology, but will also integrate sequencing, gene expression, immunology, and microscopy techniques applied to aquaculture and the study of marine organisms (e.g., SDS-PAGE to diagnose infectious fish disease; qPCR to study fish/bacteria responses to immune stimuli; etc.). This course is designed for Ocean Sciences, Aquaculture, Marine Biology, and Environmental students.

**Schedule**

Dates	Activities	Instructor	Teaching Assistant	Location
Day 1 May 08 <sup>th</sup>	Fundamentals of dry lab work	Javier Santander	Ahmed Hossain Duglas Sathees	•OCSC3010 Meeting room •OSC3012 Teaching lab
Day 2 May 09 <sup>th</sup>	Visual exploration of the marine microbial and microeukaryote world	Javier Santander	Ahmed Hossain Duglas Sathees	•OCSC3010 Meeting room •OSC3012 Teaching lab
Day 3 May 10 <sup>th</sup>	Marine Marine Microbiology	Javier Santander	Ahmed Hossain Duglas Sathees	•OCSC3010 Meeting room •OSC3012 Teaching lab
Day 4 May 11 <sup>th</sup>	Marine Molecular Biology	Javier Santander	Ahmed Hossain Duglas Sathees	•OCSC3010 Meeting room •OSC3012 Teaching lab
Day 5 May 12 <sup>th</sup>	Marine Genomics	Javier Santander	Ignacio Vasquez	•OCSC3010 Meeting room •OSC3012 Teaching lab
Day 6 May 15 <sup>th</sup>	Gene expression of Aquatic Organisms	Albert Caballero-Solares		•OCSC3010 Meeting room •OSC3012 Teaching lab
Day 7 May 16 <sup>th</sup>	Gene expression of Aquatic Organisms	Albert Caballero-Solares		•OCSC3010 Meeting room •OSC3012 Teaching lab
Day 8 May 17 <sup>th</sup>	Bioinformatics in Marine Sciences	Surendra Kumar		•OCSC3010 Meeting room
Day 9 May 18 <sup>th</sup>	Proteomics of Marine Organism	Vimbie Machimbirike		•OCSC3010 Meeting room
Day 10 May 19 <sup>rd</sup>	Evaluation & Report	All		•OCSC3010 Meeting room

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**Week 1**

Day 1, Monday May 08 <sup>th</sup> 2023				
Time	Description	Content (Brightspace)	Instructor / location	Preparation and Activities
9:00-10:00 AM	Introduction and Lab Safety	<b>Introduction</b> <b>Lecture#1: Safety and Biosafety</b>	Hossain / Santander OCSC3010 Meeting room	Read: • <a href="#">MUN Lab safety manual</a> • <a href="#">MUN Biosafety manual</a>
10:00-12:00 PM	Fundamentals Aspects of Dry Lab Work	<b>Laboratory Activity#1: Fundamentals</b> • Laboratory Notebook • Laboratory instruments • Solutions & pH • Culture media preparation • Autoclaving • Sampling collection • Marine Microbial Hunting Expedition	Santander, Hossain, Sathees, Suarez OSC3012 Teaching Lab	Read: • <a href="#">MUN autoclave manual</a> • <a href="#">DOS Laboratory and Field Notebook</a> • Santander lab fundamental video for lab working
Lunch				
13:00-13:45	Visual exploration of the marine microbial and microeukaryote world	<b>Lecture#2: Light microscopy and sample preparation; Scanning electron microscopy and sample preparation</b>	Hossain / Santander OCSC3010 Meeting room	Read:
13:45-16:00	Visual exploration of the marine microbial and microeukaryote world	<b>Laboratory Activity#2: Light microscopy</b> • Simple staining • Gram staining • Hanging drop • Blood smears • Hematocytometer • Histology	Santander, Hossain, & Sathees OSC3012 Teaching Lab & CDRF	Read:
16:00-16:30	Marine Microbiology	• Culture media plating	Santander, Hossain, & Sathees OSC3012 Teaching Lab	Read:
Day 2, Tuesday May 09 <sup>th</sup> 2023				
9:00-10:00 AM	Marine Microbiology	<b>Lecture#3: Microbial culture media and bacterial growth</b>	Sathees/ Santander OCSC3010 Meeting room	
10:00-12:00 PM	Marine Microbiology	<b>Laboratory Activity#3: Culture media, bacterial growth, and quantification</b> • Isolation • Liquid culture inoculation • Pipetting & dilutions and quantification • Growth curve	Santander, Hossain, & Sathees / OSC3012 Teaching Lab	
Lunch				
13:00-15:00	Marine Microbiology	<b>Laboratory Activity#4: Flowcytometry</b>	Santander, Hossain, & Sathees OSC3012 Teaching Lab & CDRF	
15:00-16:00	Marine Microbiology	<b>Laboratory Activity#5: Confocal microscopy</b>	Santander, Hossain, & Sathees OSC3012 Teaching Lab & CDRF	
Day 3, Wednesday May 10 <sup>th</sup> 2023				
9:00-10:00 AM	Molecular Biology	<b>Lecture#4: Molecular Biology</b>	Santander / OCSC3010 Meeting room	
10:00-11:00 AM	Molecular Biology	<b>Laboratory Activity#6: DNA, RNA, &amp; Protein preparations</b>	Santander & Hossain / OCSC3010 Meeting room	<a href="#">RNA extraction protocol</a> <a href="#">DNA extraction protocol</a> <a href="#">Protein purification protocol</a>
11:00-12:00 PM	Molecular Biology	<b>Laboratory Activity#7: PCR and Agarose electrophoresis</b>	Santander & Hossain / OCSC3010 Meeting room	
Lunch				
13:00-15:00 PM	Molecular Biology	<b>Laboratory Activity#8: SDS-PAGE</b>	Santander & Hossain / OCSC3010 Meeting room	

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15:00-16:00	Molecular Biology	<b>Laboratory Activity#9: Western blot</b>	Santander & Hossain / OCSC3010 Meeting room
<b>Day 4, Thursday May 11<sup>th</sup> 2023</b>			
9:00-10:00 AM	Genomics	<b>Lecture#5: omics</b>	Vasquez / OCSC3010 Meeting room
10:00-12:00 PM	Genomics	<b>Laboratory Activity#10: Library preparation for metagenomics</b>	Santander & Vasquez / OSC3012 Teaching Lab
13:00-15:00 PM	Genomics	<b>Laboratory Activity#11: Minion sequencing</b>	Santander & Vasquez / OSC3012 Teaching Lab
15:00-16:00 PM	Genomics	<b>Laboratory Activity#12: Data analysis</b>	Santander & Vasquez / OCSC3010 Meeting room
<b>Day 5, Friday May 12<sup>th</sup> 2023</b>			
9:00-11:00 AM	Genomics	<b>Laboratory Activity#12: Data analysis</b>	Santander & Vasquez / OCSC3010 Meeting room
11:00-12:00 PM	Marine Microbiology	<b>Laboratory Activity#12: Data analysis</b>	Santander & Hossain / OSC3012 Teaching Lab
Lunch			
13:00-15:00 PM	Molecular Biology	<b>Laboratory Activity#12: Data analysis</b>	Santander & Hossain / OSC3012 Teaching Lab
15:00-16:00 PM		<b>Laboratory Activity#12: Data analysis</b>	Santander & Hossain / OCSC3010 Meeting room

**Week 2**

<b>Day 6, Monday May 15<sup>th</sup> 2023</b>				
Time	Description	Content (Brightspace)	Instructor / location	Preparation and Activities
9:00-10:00 AM	Gene expression	<b>Lecture #6: RT-qPCR Analysis in Marine Sciences, Part I</b>	Caballero-Solares / OCSC3010 Meeting room	Read: Caballero-Solares et al. (2018). <a href="https://doi.org/10.1186/s12864-018-5188-6">https://doi.org/10.1186/s12864-018-5188-6</a>
10:00-12:00 PM	Gene expression	<b>Laboratory Activity #13: Total RNA extraction from tissue samples</b>	Caballero-Solares / OSC3012 Teaching Lab	
Lunch				
13:00-13:45	Gene expression	<b>Laboratory Activity #14: Total RNA purification and quality checking</b>	Caballero-Solares / OSC3012 Teaching Lab	
13:45-16:30	Gene expression	<b>Laboratory Activity #15: cDNA synthesis</b> Review main concepts	Caballero-Solares / OSC3012 Teaching Lab/ OCSC3010 Meeting room	
<b>Day 7, Tuesday May 16<sup>th</sup> 2023</b>				
9:00-10:00 AM	Gene expression	<b>Lecture #7: RT-qPCR Analysis in Marine Sciences, Part II</b>	Caballero-Solares / OCSC3010 Meeting room	
10:00-12:00 PM	Gene expression	<b>Laboratory Activity #16: Primer quality-checking</b>	Caballero-Solares / OSC3012 Teaching Lab	
Lunch				
13:00-16:30 PM	Gene expression	<b>Laboratory Activity #17: Comparative RT-qPCR</b> Analyze results and review main concepts	OSC3012 Teaching Lab/ OCSC3010 Meeting room	
<b>Day 8, Wednesday May 17<sup>th</sup> 2023</b>				
9:00-10:00 AM	Bioinformatics	<b>Lecture #8: Introduction to Marine Bioinformatics</b>	Surendra Kumar / OCSC3010 Meeting room	
10:00-12:00 PM	Bioinformatics	<b>Laboratory Activity #18: Sequence analysis lab</b>	Surendra Kumar / CD1004 Computer lab	
Lunch				
13:00-13:45	Bioinformatics	<b>Laboratory Activity #19: Informatics for biologists (hands-on)</b>	Surendra Kumar / CD1004 Computer Lab	

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13:45-16:30	Bioinformatics	<b>Laboratory Activity #20: Data analysis (metagenomics / transcriptomics case study)</b>	Surendra Kumar / CD1004 Computer Lab	
<b>Day 9, Thursday May 18<sup>th</sup> 2023</b>				
9:00-10:00 AM	Proteomics	<b>Lecture# 9: Introduction to Proteomics, tools, techniques and applications</b>	Vimbai Machimbirike OCSC3010 Meeting room	
10:00-12:00 PM	Proteomics	<b>Laboratory Activity#20: Guided Practical application</b>	Vimbai Machimbirike OCSC3010 Meeting room	<a href="https://www.ncbi.nlm.nih.gov/">https://www.ncbi.nlm.nih.gov/</a> <a href="https://web.expasy.org/protparam/">https://web.expasy.org/protparam/</a> <a href="https://swissmodel.expasy.org/">https://swissmodel.expasy.org/</a> <a href="https://www.ebi.ac.uk/Tools/msa/clustalo/">https://www.ebi.ac.uk/Tools/msa/clustalo/</a> <a href="http://bioinformatics.sdstate.edu/go/">http://bioinformatics.sdstate.edu/go/</a>
Lunch				
13:00-13:45 PM	Proteomics	<b>Laboratory Activity#21: Individual work</b>	Vimbai Machimbirike OCSC3010 Meeting room	
13:45-16:30 PM	Proteomics	<b>Laboratory Activity#21: Individual work</b>	Vimbai Machimbirike OCSC3010 Meeting room	
<b>Day 10, Friday May 19<sup>th</sup> 2023</b>				
	Presentations			
	Presentations			
Lunch				
	Report			
	Report			

### Format

Lecture format: 1-2 hours per day.

Practical lab format: sections of 1-4 hours a day.

Reading Assignments: The articles listed will be available in the D2L (Brightspace) portal and discussed during lectures.

### Evaluation

- Midterm #1 (20%)
- Midterm #2 (20%)
- Oral presentations (20%)
- Final Exam (25%)
- Lab Report (10%)
- Participation and attendance (5%)

**Tests (20% each, total 40%):** The student will be evaluated in three different aspects, including fundamental concepts, contextualization of the concept, and application of the learned concepts. Advice on how to prepare will be provided.

**Oral presentations (20%):** The students have to present 4 articles (5% each). Students prepare and deliver a slideshow covering the methods, results, and interpretation of specific assigned article. Advice on how to create efficient slideshows will be provided. The format will be 10-12 min presentation and 3 min questions. The evaluation rubric will be provided in advance.

**Assignments (5%):** The assignments will be based on fundamental literature (Book chapters) and a questionnaire. The answer to the questions will be discussed during lectures in addition to the articles.

**Participation (10%):** Students are expected to participate actively in all aspects of the course, especially during discussion lectures. Every student is assessed continuously throughout the course on his/her level of involvement, from the sharing of ideas and opinions during discussions, to the general attitude and level of preparation before and during class and oral presentations.

**Lab Report (10%):** It is expected that the student produces a high-quality lab report including details for the material and method used.

**Comprehensive final exam (20%):** The format of the final exam will not differ from the regular tests, however all the lectures and oral presentations will be evaluated. Advice on how to prepare for the exam will be provided.

**Bibliography (the book listed will be placed on reserve at the library)**

- Janeway's Immunobiology, 9th edition, 2016. Kenneth Murphy and Casey Weaver. Garland Science.  
[https://www.academia.edu/40521511/Janeways\\_Immunobiology\\_9th\\_Edition](https://www.academia.edu/40521511/Janeways_Immunobiology_9th_Edition)

**ATTENDANCE AND PARTICIPATION**

Regular attendance and class participation are expected of all students. An important component of your final grade will be an assessment of your active class participation in a variety of dynamic learning exercises throughout the semester. This includes assessment of a student's ability to critically analyze and interpret published scientific literature. Excessive absences and/or a lack of active participation could result in a lower course grade. Should a student miss a class, it is that student's responsibility to obtain notes from another classmate. Work-related absences, etc., are not a legitimate excuse for missing class. Absent students can NOT make up daily in class performance-based assessment points. If you miss an exam because of an *excused* absence you will be allowed to make up the exam but *only if you meet the criteria of MUN regulations*. There are NO makeups for exams missed due to unexcused absences.

**PLAGIARISM**

As outlined in Section 4.12.4 of MUN's Calendar, plagiarism (the act of presenting the ideas or works of another as one's own) is a form of academic offence. Plagiarism will not be tolerated in this course. Any student who plagiarizes another's work exposes himself/herself to the disciplinary measures outlined in section 4.12 of MUN's Calendar, which includes course expulsion. We will provide clear guidelines on how to avoid this problem.

**EQUITY, ACCESSIBILITY AND COLLABORATION.**

Memorial University of Newfoundland is committed to supporting inclusive education based on the principles of equity, accessibility and collaboration. Accommodations are provided within the scope of the University Policies for the Accommodations for Students with Disabilities ([www.mun.ca/policy/site/policy.php?id=239](http://www.mun.ca/policy/site/policy.php?id=239)). Students who may need an academic accommodation are asked to initiate the request with the Glenn Roy Blundon Centre at the earliest opportunity ([www.mun.ca/blundon](http://www.mun.ca/blundon)).

**MISCONDUCT (UNIVERSITY REGULATION 6.12).**

Students are expected to adhere to those principles which constitute proper academic conduct. A student has the responsibility to know which actions, as described under Academic Offences in the University Regulations, could be construed as dishonest or improper. Students found guilty of an academic offence may be subject to a number of penalties commensurate with the offence including reprimand, reduction of grade, probation, suspension or expulsion from the University. For more information regarding this policy, students should refer to the University Regulations for Academic Misconduct (Section 6.12) in the University Calendar.