DOMINICAN UNIVERSITY of CALIFORNIA 1890

Mission

Dominican University of California transforms lives. We are an independent, learner-centered, international university of Catholic heritage, which interweaves Dominican values, the liberal arts and sciences, and the skills and knowledge necessary to live and work in an interdependent world.

Department of Natural Science and Mathematics

Chemistry and Biology Research Methodology I

BIO 2990.5 – 1 Unit_Spring 2026
Fridays, 9:00 am – 11:30 am
Location: Science Building Rm 107

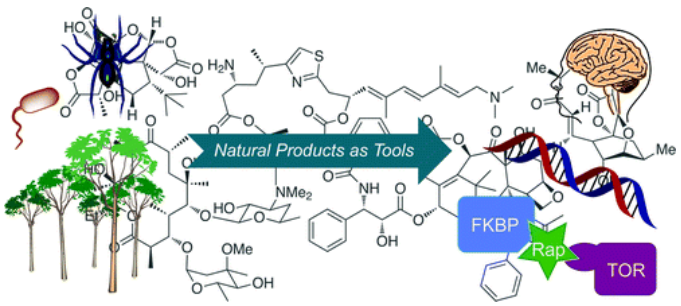
Instructors:

Tyler Johnson, PhD
Associate Professor of Chemistry
email: tyler.johnson@dominican.edu
Office Location: Science Building Rm 128
Office Hours: Mon & Wed 12:00-1:00 pm (Zoom)

Matthew Nickel, BSc
Graduate Student & Adjunct Faculty
email: Matthew.Nickel@dominican.edu
Office Location: Science Building Rm 110
Office Hours: Wed 1:00-2:00 pm

Research Group -	**Team Leaders (Consultants):**
1) Matthew Nickel	email: matthew.nickel@dominican.edu
2) Natalie Oyler	email: natalie.oyler@students.dominican.edu
2) Victoria Barlow	email: victoria.barlow@students.dominican.edu
3) Brisa Navarette	email: brisa.navarretesandoval@students.dominican.edu
3) Brooke Young	email: brooke.young@students.dominican.edu
4) Linel Tolentino	email: linel.tolentino@students.dominican.edu
4) Angelly Escalante	email: angelly.escalante@students.dominican.edu

I. Research Description: Natural products chemistry has served as the backbone for modern therapeutic development programs since the dawn of the pharmaceutical age. Compounds derived from plants and microorganisms have enjoyed a rich history for providing inspiration for most of the molecules we use in medicine today. Marine natural products from the ocean represent an underexplored source to investigate lead compounds for discovery in this area. Many are now being pursued as therapeutic lead structures for drug development, and a small but growing number have also gone on to serve as important chemical probes (tool compounds) in chemical biology research. Chemical biology is a burgeoning field at the interface of chemistry, biology and biomedical research. It uses structurally distinct compounds, which serve as chemical probes for specifically disrupting the cell cycle, to address fundamental questions in molecular, cellular and developmental biology. The long range goal of our laboratory is to purify natural products from marine sponge extracts and prepare them to be screened as libraries of pure compounds against new disease targets to search for:
a) therapeutic lead structures in biomedical research and b) novel probes in chemical biology. Basic methodology for how to prepare marine extracts to isolate pure compounds for biomedical research will be presented.



II. Course Materials:

- All materials will be provided by the instructor. It is the student's responsibility to obtain and read this material. The majority of the readings will be accessible online (Google), through Moodle, research lab website or scientific databases available from DUC Library.

III. Learning/Teaching Methods and Student Expectations: Subject material will be covered through lecture, discussion and computer experiments. Students are responsible for reading the relevant journal articles and reviews assigned in order to develop an understanding of their specific research topic. Students are expected to attend every class session and play an active role in carrying out the proposed experiments related to their research project.

IV. Grading: Grades will be distributed as follows:

- Scientific Article Summaries	20 pts	Due Day 2
- Mini research project	20 pts	Due Day 2
- Power point reports	20 pts	Due Day 2
- Rotation Summary	20 pts	Due (see p. 5)
- Course reflection	20 pts	Due (see p. 5)
	100 pts	

VI. Tentative Schedule

Rotation **Day 1:** Friday

10 min. - Introductions, syllabus, review article - Marine Natural Products Chemistry (read at home - answer Qs),
20 min. - Assign sponges to groups 1-3. Turbo extraction of sponge (MeOH, soak 3 hrs) – consultants assist
1 hr - Introduction to marine natural products chemistry & chemical biology.

- 5 min. intermission

5 min. Assign *Marine Drugs* research articles to groups: (electronic copies on research lab webpage)
15 min - Mini lecture on marine natural products extraction and polarity &
30 min - Tutorial on how to prepare a powerpoint presentation (electronic examples on research lab webpage)

10 min. – pour off Methanol extractions into trays (consultants assist) to generate total polar extract (TPE).

Adjourn ~ 11:30am

Homework: Due Day 2

Read: Marine natural products chemistry review article ~ answer questions
Read: ***Marine Drugs*** research articles and answer the worksheet questions
Prepare: mini (~10 min.) powerpoint presentation of their sponge reporting on:
1) where it is collected (biogeographical variations),
2) what type of: a) polar & b) non polar chemistry it possess (show the structures),
3) what biological (disease) targets does associated chemistry of the sponge effect

Note: Powerpoint Research talks (15 min. max, 7-10 slides) have fun with it ☺
ALL SCIENTIFIC PRESENTATIONS MUST BE MADE USING "Powerpoint". No exceptions. Otherwise 5 pts off.
Selected examples of previous sponge-derived chemistry powerpoint presentations – on research lab webpage

Rotation **Day 2:** Friday

30 min. - Review Questions of review article

1 hr - Extract TPE layer in tray (consultants assist) of selected sponges using Water (W) & Dichloromethane (DCM). Solvent partition into separatory funnels, invert and let sit, 30 min. Drain into 2 beakers labeled as the *polar* **water** (**W**) and *non-polar* **fat** (**F**) layers.

30 min - Photograph color differences of the **W** vs **F** fractions in each beaker to determine qualitatively which extract (the **W** or **F)** beaker is more likely enriched with either the *polar* or *non polar* chemistry reported from each of your groups assigned ***Marine drugs*** research papers. (consultants assist)

Add the above photographs to your powerpoint presentations.
***Note:** make sure you highlight your proposed [chemistry] data here using the photos is *qualitative* (observation based) and **NOT** *quantitative* (numerically or quantifiably derived)

1 hr - Powerpoint presentations (≤15 min.) – 20 pts - students grade each other ~ (rubric provided)

DONE ☺ **NOTES:** Syllabus and Schedule subject to change ~ Thank you for being flexible.

Student Learning Outcomes:
1. Comprehension and integration of fundamental scientific concepts in the biological and physical sciences.
2. The ability to perform techniques in modern science.
3. The ability to apply scientific and mathematical principles in developing an independent research project, utilizing appropriate scientific techniques, including information and data analysis technology.
4. Objectivity in scientific investigations by suspending preliminary judgments, drawing conclusions only from observable and testable data, and attempting to exclude cultural assumptions and biases.
5. Understanding of a spectrum of chemical principles and knowledge in all major areas of chemistry.
6. Skills in analysis, synthesis, and quantitative reasoning that are essential to establish and rigorously test hypotheses.
7. Competency in working in a chemistry laboratory, especially with respect to:
a. general laboratory practice guidelines, including safety and standard operating procedures (SOPS)
b. qualitative and quantitative chemical analyses, extraction and solvent partitioning
8. The ability to organize and present chemical information in written and oral format using available information technology.
9. Understanding of the importance of chemistry in society, environment and industry.
10. The skills necessary to pursue employment or further education involving inter-disciplinary areas of biomedical research.

Student Learning Outcomes:

1. Comprehension and integration of fundamental scientific concepts in the biological and physical sciences.
2. The ability to perform techniques in modern science.
3. The ability to apply scientific and mathematical principles in developing an independent research project, utilizing appropriate scientific techniques, including information and data analysis technology.
4. Objectivity in scientific investigations by suspending preliminary judgments, drawing conclusions only from observable and testable data, and attempting to exclude cultural assumptions and biases.
5. Understanding of a spectrum of chemical principles and knowledge in all major areas of chemistry.
6. Skills in analysis, synthesis, and quantitative reasoning that are essential to establish and rigorously test hypotheses.
7. Competency in working in a chemistry laboratory, especially with respect to:
   a. general laboratory practice guidelines, including safety
   b. qualitative and quantitative chemical analyses, reactions, and synthesis; and
   c. the use of modern chemical instrumentation
8. The ability to organize & present chemical information in written & oral format using the available information technology.
9. Understanding of the importance of chemistry in society, environment and industry.
10. The skills necessary to pursue employment or further education in chemistry or inter-disciplinary areas involving chemistry.

Rotation no.	Consultant name(s)/group(s)	Assigned Genus & 2-3 students/group
1	Matt	*Theonella*
1	NEO/Victoria	*Jaspis*
1	Brisa/Brooke	*Haliclona*
1	Linel/Angelly	*Plakortis*
2	Matt	*Haliclona*
2	NEO/Victoria	*Plakortis*
2	Brisa/Brooke	*Theonella*
2	Linel/Angelly	*Jaspis*
3	Matt	*Jaspis*
3	NEO/Victoria	*Haliclona*
3	Brisa/Brooke	*Plakortis*
3	Linel/Angelly	*Theonella*
4	Matt	*Plakortis*
4	NEO/Victoria	*Theonella*
4	Brisa/Brooke	*Jaspis*
4	Linel/Angelly	*Haliclona*

BIO 2990 PROFESSORS & ROTATION ORDER

9:30 Start Rotation Dates:	1/30-2/6	2/13-2/20	2/27-3/6	3/20-3/27
	Rotation 1	Rotation 2	Rotation 3	Rotation 4
Cohort 1 (9)	**Coelho (lab 106)**	**Johnson (lab 107)**	**Gurrola (lab 103)**	**McNally (lab 229)**
Caroline Alaniz				
Diego Alas Quintanilla				
Catalina Aldana				
Sophia Bernabe				
Yenifer Carmona Tellez				
Jair Castro Espinoza				
Sophia Clemente				
Angie Dimas				
Maria Esteban Tucux				
	Rotation 1	Rotation 2	Rotation 3	Rotation 4
Cohort 2 (8)	**Johnson (lab 107)**	**Gurrola (lab 103)**	**McNally (lab 229)**	**Coelho (lab 106)**
Maria Gavrilov				
Dakota Harrell				
Amanda Henriquez Rivera				
Alexa Ines				
Ayla Johanski				
Karla Jovel Cruz				
Emily Klippenstein				
Brian Luis Santiago Laxamana				
	Rotation 1	Rotation 2	Rotation 3	Rotation 4
Cohort 3 (9)	**Gurrola (lab 103)**	**McNally (lab 229)**	**Coelho (lab 106)**	**Johnson (lab 107)**
Hanna Levine				
Kelsey Levine				
Jady Magnuson				
Savannah May				
Megan Ashley Ngim				
Daniela Pazos				
Mateo Polanco				
Makeila Rebusi				
Alex Reiterman				
	Rotation 1	Rotation 2	Rotation 3	Rotation 4
Cohort 4 (8)	**McNally (lab 229)**	**Coelho (lab 106)**	**Johnson (lab 107)**	**Gurrola (lab 103)**
Dejean Rodgers				
Janiya Sawyer				
Alexis Schwartz				
Kylie Simpkins				
Dylan Tawes				
Melissa Isabel Vicente Ordonez				
Juniper Yoshihara				
Eshal Zubair				

Class Schedule

Jan 30	Introduction to Research Methodology and Professors, Syllabus Discussion and Semester Overview (Zoom)
30	Rotation 1
Feb 6	Rotation 1
13	Rotation 2 – report to new faculty *Due: rotation summary due to instructor of rotation 1*
20	Rotation 2
27	Rotation 3 *Due: rotation summary due to instructor of rotation 2*
Mar 6	Rotation 3
13	NO CLASS – Spring Break
20	Rotation 4 *Due: rotation summary due to instructor of rotation 3*
27	Rotation 4
April 3	NO CLASS - Good Friday
Apr 10	Digital portfolio workshop/ 4990/3990 placement options Due: rotation summary due to instructor of rotation 4
17	Presentation work time - research/faculty consultations – with rotation 1 instructor *Due: Class Reflection Assignment due to instructor of rotation 1** *(This will be uploaded to the digital portfolio too)*
24	Presentation work time - research/faculty consultations – with rotation 1 instructor
May 1 Science Center 1st floor (3 rooms)	Oral Presentations in Science Center *Due: Portfolio to instructor of rotation 1*

This syllabus is a guideline and may be altered during the semester. Any changes will be discussed in class.