# Syllabus: Collaborative Near Shore Biogeochemical Research

SIO 269 spring quarter 2014

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| **Lectures:** | Mondays 14:00-17:00 |
| **Location:** | TBD |
| **Office hours:** | I have an open door policy for students but happy to schedule appointments |


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| **INSTRUCTOR**: | Andreas Andersson |
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**OBJECTIVE:** The theme of this class is to foster and apply an ***inquiry***, ***experience***, and ***collaborative***-based learning approach that aims to integrate teaching and cutting edge research on the topic of biogeochemistry. As part of this class we will collectively develop and carry out a collaborative research project in a near-shore environment focusing on biogeochemical processes. The class is divided in four modules focused on one or several aspects relevant to the success of the project.

**Module 1**

Topic: Background and introduction to the class and the scientific question
Topic: Introduction to teamwork and collaborations
Topic: Literature search
Activity: Team building event TBD
Activity: Assemble teams based on interest and background
Activity: Background research and literature review
Topic: Presentation techniques
Activity: Team presentations on literature review

**Module 2**

Activity: Define/discuss research questions to be addressed
Activity: Develop a research plan within each team and within the group
Activity: Refine research plan within each team
Topic: Proposal writing
Activity: Develop brief research proposal (what questions/hypothesis will be addressed, how will they be addressed, what results are expected?).
Activity Team presentations/group discussion on proposals

**Module 3**

Topic: Instrument training, demonstrations, and lab tours for basic measurements and sample analyses required for the project
Activity: Preparation of field/laboratory investigation
Activity: Execution of field/laboratory investigation
Activity: Laboratory and sample analyses

Activity: Preliminary data evaluation
Topic: Data analysis, statistics, and modeling
Activity: Data and statistical analyses
Activity: Team presentations and discussion of preliminary results

**Module 4**
Topic: Writing and publishing scientific papers and reports
Activity: Write-up of results
Activity: Final presentation of results
Activity: Course evaluation and discussion

**PARTICIPATION & ATTENDANCE:**
Because the class is based on a team effort, attendance is mandatory. Students are also anticipated to contribute and participate in all aspects of the project.

**GRADING:**
The main objective is that you learn something from this class. Grading will be based mainly on your ***efforts*** to participate and completing group and individual assignments.

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| Participation and contribution | 50% |
| Assignments | 50% |

**ADDITIONAL BACKGROUND:**

Numerous education studies have shown strong evidence that ***inquiry***, ***experience,*** and ***collaborative***-based approaches to learning are beneficial for both individual and collective learning (e.g., Barron and Darling-Hammond, 2008). Similarly, research on problem solving techniques has demonstrated that a team of individuals in general is more effective and successful solving a problem than each individual by themself (Scott, 2007), i.e., "the whole is greater than the sum of its parts" (Aristotle). This concept has been well established in the modern society and employed by a wide variety of both private and governmental organizations that take great care in creating successful teams and spend significant resources on training and team building (McClough and Rogelberg, 2003; Galvin, 2003; Scott, 2007). Yet, collaborative based learning and approaches to problem solving in undergraduate and graduate education is in most cases limited. For most college and university students, collaborative learning is restricted to a few group projects associated with certain classes, and for some students by participation in interdisciplinary research projects. The field of oceanography is inherently interdisciplinary because it often requires integration of biological, chemical, and physical processes to understand a particular problem. One such problem is for example ocean acidification. However, no or little training and guidance are provided for students in this field on how to work as part of a team, and how to most effectively contribute and benefit from the success of the team.

The overarching theme of this class is to foster and apply an ***inquiry***, ***experience***, and ***collaborative***-based learning approach that aims to integrate teaching and cutting edge research on the topic of ocean acidification and biogeochemistry. The aims are to provide faster and greater assimilation of

knowledge for participating graduate and undergraduate students relative to their own learning potential and to increase the probability for the advancement and understanding of an intriguing scientific problem. The idea and justification for this team-based, collaborative approach is that the students will complement, assist and learn from each other. The team based approach will contribute to enhanced knowledge growth of each student, but also enhancing the probability for progress and success of the postulated research questions. The basic concept of the class focuses on a specific research question in a near-shore environment.

In this case the research will focus on elemental cycling in near-shore environments and how biogeochemical processes modify seawater $CO_2$ chemistry. Although these questions form the foundation for the course, the research activities are not limited to these topics. The questions simply serve as foundations for the course, which require some basic knowledge, research methodology, and use of specific instruments and skills, but to which additional ideas and research questions can be built upon. It is up to the students to develop these additional questions and research ideas, and the instructor will simply facilitate these activities within the scope of what is possible. However, at a major research institution as SIO and with budgeted funds available to pay for instrument time and/or sample analyses, a broad range of research aspects can be accommodated. From past experiences, students take this opportunity to the fullest and design highly creative and interdisciplinary projects that in the end generate an excellent dataset with a multi-dimensional holistic view of a particular system or problem.

As important it is for students to learn conceptual ideas and theory in the classroom, it is as critical for students to experience how these concepts work and encompass themselves in nature. Connecting theory with the real world facilitates a stronger understanding for a topic or concept, but also stimulates the curiosity and satisfaction students experience from learning and discovering previously uncharted territories.

In addition to the inquiry-, experience-, and collaborative-based aspects of the course, it will place additional emphasis and training on developing good presentation skills, proposal writing, and manuscript preparation. The teaching plan is ambitious, but it is based on that students have different backgrounds and experiences that complement each other, and that they work together as a team rather than as individuals to accomplish the end goals of each module.

**REFERENCES:**


Barron, B., and Darling-Hammond, L., 2008. Teaching for meaningful learning: a review of research and inquiry-based and cooperative learning. In Darling-Hammond et al. (eds), *Powerful Learning: What We Know about Teaching for Understanding*, John Wiley & Sons, Inc.

Galvin, T., 2003. Industry report. Training Magazine's 22nd annual comprehensive analysis of employer-sponsored training in the United States. *Training*, 11, 21-45.

McClough, A. C., and Rogelberg, S. G., 2003. Selection in teams: An exploration of the teamwork knowledge, skills and ability test. *International Journal of Selection and Assessment*, 11, 56-66.

Scott, S., 2007. Team performance and the problem-solving approach. *Journal of Industrial Technology*, 23, 2-7.