GEO 320/520 Glacial Geology  3 credits
(Prerequisites: At least one introductory course in geology is required)

COURSE GOAL:
This introductory undergraduate/graduate course in glacial geology prepares students to understand the processes involved in the development of glacial features and how to identify them. Emphasis is on Long Island’s glacial features

COURSE CONTEXT
This is an elective course developed for undergraduate Geology and Earth and Space Science majors and for graduate Geology and Earth Science education majors. It allows for in-depth study of a topic of particular relevance to Long Island geology.

INSTRUCTIONAL COMPONENTS
A. Concept Presentation
   • Presentation of material by PowerPoint lecture slides with a focus on in-class discussion of recent developments related to glacial geology in the news
   • Slides are made available on Blackboard prior to class to facilitate note-taking and for later study
   • Optional fieldtrips for direct observation and field description

B. Concept Reinforcement
   • During lectures questions are asked regarding material just presented:
     In-class “beginning” quiz composed of multiple choice, true-false, or short answer questions taken first by individuals, then as a group to foster in-depth discussion among group members.
     In-class “end” quiz question, first discussed among class members and then answered individually with emphasis on using sketches to explain concepts.
   • In class midterm and final exams taken individually composed of multiple choice, true-false, or short answer questions and essay questions similar to the end quiz questions.
   • Six optional half-day field trips on Long Island provide opportunities for students to see relevant geologic features in the field.

C. Scientific Communication
   • Each semester a focused topic is selected for the class (e.g., Younger Dryas event). The class is divided into groups of about four students each; each group is assigned a narrower topic within the class topic. Each student prepares and presents an oral presentation on a portion of his/her group topic.
   • All graduate students prepare a research paper requiring a detailed survey and summary of the primary peer-reviewed literature on chosen research related to the topic of the semester.
   • Each week a news article regarding glacial geology is assigned and a question relating to the article is presented regarding the news article.
COURSE LOGISTICS:
The course content is presented in one-three hour lecture with discussion period weekly. There is a quiz at the beginning on the material from readings and presentations in the previous class and a quiz with a focused question at the end of the class on material presented in the class. There are no teaching assistants.

EXPECTED COURSE OUTCOMES
By the end of the course, the students will be able to:

• Recognize glacial geologic features on maps, DEMs and in the field
• Understand a specific event (e.g., the Younger Dryas (YD) event) and associated controversies. For example,
  - The rate of climate change at the beginning and end of the Younger Dryas
  - The global extent of the YD event
  - Which extinctions may be related to the YD event
  - How stopping thermohaline circulation may have caused the YD event
  - How the thermohaline circulation may have been stopped
  - Archaeological evidence for the YD event
  - Whether extraterrestrial impacts on the Laurentian Ice Sheet may be responsible for the YD event
  - Understand the evidence for extraterrestrial impact(s)
  - Discuss whether the Carolina Bays were or were not related to the YD event.
• Discuss the events in the Cenozoic Ice age
• Explain which methods can be used to date events during the Cenozoic
• Describe the pattern of advances and retreats of continental ice sheets
• Explain how this pattern may be related to Milankovic cycles
• Understand the properties of ice related to glaciers; how the geothermal gradient determines whether the base of glacier is wet or dry; how snow is converted to ice; why ice which is a solid can flow
• Know the types and location of glaciers
• Recognize that Long Island consists of a thick sequence of unconsolidated sediments and is ideal for developing glaciotectonic features.
• Explain the mechanisms of Glacial Erosion
• Describe glacial landforms an recognize them on Long Island
• Distinguish glacial sediments deposited in water and by wind
• Explain the history of the periglacial climate following the Last Glacial Maximum
• Understand the climate conditions and ecology of an area in permafrost
• Explain how ice wedges form and how their fossil remains can be used to evaluate whether an area once had a periglacial climate
• Discuss how a pingo forms and how to recognize fossil remnants of a pingo.
• Compare the shear strengths of frozen and unfrozen mud, sand and gravel
• Explain Isostasy
• Describe the paths of the retreating glacier in New England after the Last Glacial Maximum
• Describe the rate of retreat and the climatic conditions responsible for the retreat
• Explain why moraines formed by the retreating glacier are not easily recognized in New England
• Explain what morphosequences are and how they can be used to locate positions of the glacier on its retreat.

GOALS FOR BROADER SKILLS
A. For graduate students develop scientific writing skills through research report preparation and criticism. Students usually are required to revise their report after submitting an earlier draft.
B. For all students, develop oral presentation skills
C. Articulation of concepts through group discussions

ASSESSMENT OF ATTAINMENT OF COURSE GOALS
There are quizzes at the beginning and end of each class period, a midterm and final exam, oral presentations by all students and a research report by graduate students.
REQUIRED MATERIALS:
2. Blackboard. Stony Brook’s Blackboard system can be accessed from the following website: http://blackboard.sunysb.edu. To log into Blackboard, you will need your Net ID username and a password. To find out and set your Net ID Password, you will need to log into SOLAR.

ADDITIONAL COURSE REQUIREMENT:
**Participation in a Work Group** To achieve the maximum benefit from this course it is essential that you are an active participating member of a work group. Each work group will emphasize in their oral presentations and reports aspects of a focus topic.

CLASS STRUCTURE
5:30

There will be 10 minutes for students to discuss the material for the beginning quiz with their groups or to ask me questions. It is essential that you arrive on time. Quiz covers material from the previous week.

5:40 to 6:00 Quiz
6:00 to 7:00 Student oral presentations and/or Lecture
7:00 to 7:15 Break
7:15 to 8:10 Lecture or Workshop
8:10 to 8:30 Quiz

Spring 2014 WORK GROUPS

*Climate change* Wala Canario Matthew Green Kelly Haspel Brian Mulder
*Extinctions* Keith Chojnacki Amanda Farnbach Hugh Jung David Roberts
*Thermohaline Circulation* John Heyman Brandon Bell Ella Holme Jessica Lee
*Archaeology* Danielle DeSimone Philip Maggio Amy Kasten Christopher Nickel
*Impact Physics* Katherine Dominguez Philip Bryan Meridith Kraner Michael Sapienza
*Evidence for impact(s)* Kim Min Seop Dylan Duprez Ashley Hastings Christopher Plante
*Carolina Bays* Michael Noll Michael Guardino Adrianna Corso Gavin Piccione
TOPICS

*Climate Change*
This group will provide evidence for climate effects associated with the Younger Dryas in North America, Europe and the southern hemisphere.

*Extinctions*
This group will look at the evidence and timing of extinctions of groups or selected mega fauna in North America and the rest of the world that are occurring about the beginning of the Younger Dryas at 12,900 calendar years and discuss the various hypotheses explaining the extinctions.

*Thermohaline Circulation*
This group will provide a detailed description of thermohaline circulation and whether stopping it will have an effect on climate. This should be directly related to the addition of freshwater in the North Atlantic.

*Archaeology*
This group will describe the Clovis Culture lifestyle, provide the evidence regarding whether the Clovis Culture people may have caused the extinction of mega-fauna, whether the culture disappeared at the beginning of Younger Dryas and whether there was a significant drop in the Paleo-Indian population at that time.

*Impact Physics*
This group will discuss the physics related to a bolide exploding in the atmosphere over the Laurentian ice sheet, what would happen if it collided with Laurentian Ice sheet and comparing these results with the evidence for an impact at the beginning of the Younger Dryas and interacting with the Carolina Bays group discussing whether secondary ejecta may have formed the Carolina bays.

*Evidence for impact(s)*
There are quite a few research reports giving evidence for and against an extraterrestrial body exploding over the Laurentian ice sheet or colliding with it at the beginning of the Younger Dryas. Your job is to search through the evidence and give an unbiased review of the reports. Carolina bays.

*Carolina Bays*
The Carolina bays are enigmatic rimmed, flat bottom elliptical shaped objects that occur along the east coast of the United States. It is estimated that there may be some 500,000 of these features. Your job is to review the characteristics, geologic nature and dating of these features. These features are found on Long Island and someone should look specifically look at the features on Long Island.

*ORAL PRESENTATIONS*
Each student must make one oral presentation as part of the work group presentation. The oral presentations should cover material in greater depth than we have in class. A good strategy is to discuss the results in recent research papers. The work group must develop a set of oral presentations on their topic. Each oral presentation should be 4 + 1 minutes in length and should include pertinent illustrated material in a PowerPoint presentation. One member of the group should give the introductory material, which is not to be repeated by the following
speakers. You may also prepare handouts for the class. It is essential that practice talks be given before the work group prior to the presentation. A presentation will be worth up to 20 points to the individual giving the presentation. The work group will agree on which individual shall give each presentation. It is expected that there will be discussion by the class after the presentations. A rubric for grading the oral presentations is on BlackBoard.

**RESEARCH REPORTS**

A research report is required of students in GEO 520. The topic must be established by Feb. 13. The topic should be consistent with that of your workgroup and should present insight into a very narrow aspect of the topic. For example, it might describe features in one limited area that have been well studied with controversial results. Please talk to me about the topic you are considering. An outline with an essentially complete set of references is due on Feb. 27. Please place all documents on BlackBoard in the file exchange for your workgroup. The completed report is due March 27. It is highly likely I may ask you to revise the report in a timely manner before it is accepted.

Each completed report should contain a 1200 word synopsis of the topic written by you with appropriate figures and tables, a list of references cited and pertinent links on the Internet. The references cited should mainly include research reports in journals or books. Textbooks and the web may be sources for finding appropriate reports. You should use the Web of Science and GeoRef to find appropriate literature.

A rubric for the research report is available on BlackBoard. **If your grade is less than 40, the report will not be accepted and must be rewritten to receive a grade in the course.**

**COURSE EVALUATION:**

There will be weekly quizzes a midterm and a final exam.

**Quiz Policy** The beginning quiz will be first taken individually. Each work group will then take the quiz as a group. Each student’s score will be the average of the individual score and the work group score, but only if a student receives a grade of 60% or higher on their individual score. The weekly quizzes will be mainly short answer or multiple choice. If longer answers are expected, you will be alerted in advance. If a student arrives after his/her workgroup has begun taking the quiz, the student cannot participate in the work group discussion. The quiz at the end of the class will be an essay question usually involving hand-drawn illustrations about the material covered during that class period. Discussion with the work group is encouraged, the quiz is open book but taken as individuals.

**Bonus points**

It is possible to obtain bonus points for relevant on-campus seminars and glacial geology field trips.

**OPTIONAL FIELD TRIPS**

- **Saturday April 5**
  - 9AM to 12 Noon
  - 6 bonus points
  - Geology of Avalon
Geology of Avalon Park and Port Jefferson
This Field trip will consider geomorphic features in Avalon Park in Stony Brook and then we will travel to Port Jefferson along tunnel valleys. Port Jefferson and Port Jefferson Harbor are the site of a large tunnel valley formed by an outburst of water from under the glacier.

Geology of Stony Brook Campus
This is a walking field trip in which we will study rock types among the erratics, a short stratigraphic section of till overlain by sand and then loess, tunnel valleys, evidence for glacial tectonics, hummocky terrain, kettle holes and the boundary between the Harbor Hill Moraine and the Terryville Outwash Plain.

Geology of Wildwood State Park
During this field trip we will characterize the different types of the erratics (boulders) on the beach discuss the history of the bluffs, and consider the history and sources of the loess (wind-blown silt) in a kettle hole in the park.

Geology and Hydrology of the Carmans River
On this trip we will consider how the headwaters of the Carmans River has been migrating northward in an originally dry valley that developed during the last glacial maximum some 20,000 years ago. This smaller valley occupied by the Carmans River developed in a much larger valley that most likely also formed during the Last Glacial Maximum. On this trip we will consider both the development of the larger valley and features within it such as dry valleys and kettles.

Geology of Weld Sanctuary
At Weld preserve in Nissequogue, we will discuss the effects of sea level rise on the development of a wetland in a tunnel valley and see in-place roots of a tree in the intertidal zone, which provides evidence of recent sea level rise. If time permits we will visit a well-developed kettle hole in the sanctuary.

GRADING Exams
There will be a mid-semester exam and a final exam Each worth up to 100 points.

Quizzes
Twelve quizzes at the beginning of class 120
Each worth up to 10 points.
Fourteen quizzes at the end of class Each worth up to 5 points

**Oral Report**
Each student must present one oral report Worth up to 20 points

**Research Report**
The research report for students in GEO 520 is worth up to 50 points.

**Total Possible Points For GEO 320** 410
**Total Possible Points For GEO 520** 460

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**COURSE SCHEDULE**

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<tr>
<td>Jan. 30</td>
<td>Introduction and Younger Dryas</td>
<td>Ch. 11, 13</td>
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<td>The Cenozoic Ice Age</td>
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<td>Ice Properties and Causes of Glaciation</td>
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<td>Glacial Transportation and Deposition</td>
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<td>Glacial Landforms formed by Glacial Sediments</td>
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<td>Fluvial Sediments and Landforms</td>
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<td>Glaciomarine and Glaciolacustrine Environments</td>
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<td>Isostasy and Eustasy</td>
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<td>May 1</td>
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IMPORTANT DATES

Feb. 13       Topic for Research Report
Feb. 27       Outline for Research Report
March 13      Mid Semester Exam
March 20      No class spring recess
March 27      Research Report due
May ?         Final Exam

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DISABILITY SUPPORT SERVICES (DSS) STATEMENT
If you have a physical, psychological, medical, or learning disability that may impact your course work, please contact Disability Support Services (631) 632-6748 or http://studentaffairs.stonybrook.edu/dss/. They will determine with you what accommodations are necessary and appropriate. All information and documentation is confidential. Students who require assistance during emergency evacuation are encouraged to discuss their needs with their professors and Disability Support Services. For procedures and information go to the following website: http://www.stonybrook.edu/ehs/fire/disabilities/asp.

ACADEMIC INTEGRITY STATEMENT
Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty are required to report any suspected instance of academic dishonesty to the Academic Judiciary. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website at http://www.stonybrook.edu/uaa/academicjudiciary/

CRITICAL INCIDENT STATEMENT
Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of Judicial Affairs any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, and/or inhibits students' ability to learn.

CLASS CONDUCT
All cell phones, iPods, and other electronic devices should be turned off during class to minimize distractions and interruptions. Class participation, including questions and discussion is encouraged. Please treat all others in a respectful manner appropriate for a university setting.

ACADEMIC INTEGRITY
Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty is required to report any suspected instances of academic dishonesty to the Academic Judiciary. Faculty in the Health Sciences Center (School of Health Technology & Management, Nursing, Social Welfare, Dental Medicine) and School of Medicine are required to follow their school-specific procedures. For more comprehensive information on academic integrity, including categories of academic dishonesty please refer to the academic judiciary website at http://www.stonybrook.edu/uaa/academicjudiciary/

**MINIMAL INSTRUCTIONAL AND STUDENT RESPONSIBILITIES**

See http://sb.cc.stonybrook.edu/bulletin/current/policiesandregulations/policies_expectations/min_instructional_student_resp.php

**ACADEMIC SUCCESS AND TUTORING CENTER**

The Academic Success and Tutoring Center (ASTC) supports Stony Brook University’s mission of ensuring a comprehensive, high quality undergraduate education by providing services that complement classroom instruction and encourage student success. http://www.stonybrook.edu/commcms/academic_success/