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Earth Science minor

I. Program Summary

The proposed standalone minor in Earth Science consists of five courses (20 credits), three of which are required, whilst two are electives. The minor will provide students with a firm grounding in earth science, including both physical and historical geology (the basis of all earth science majors). Students will gain experience in geological cartographic techniques, be able to identify the major minerals and rocks, and gain practice in geological field techniques. The electives provide an opportunity to explore a wide range of aspects of earth science. Research opportunities in geology and paleontology are available.

Of the five courses, two (both of which are required) have laboratory sections, providing students plenty of hands-on experience in both laboratory and field settings. These courses are also writing intensive, giving students plenty of opportunity to

- i. Assessment for all 3 outcomes will take place in the assignments (presentations, field reports, lit reviews, informal communication) in GEOL 105 and 326.

Assessment would take place within the 3 required courses (two of which – including the specific measures indicated - are already mined on a regular basis for assessment within the Environmental Science major). All of the measures indicated above are direct measures of assessment. For some students (those seeking Teacher Education certification), we may also be able to use Earth Science Content Praxis test scores as an indirect assessment measure.

As for all other programs at Ramapo, an Assessment Plan will be submitted early in the Fall semester, and reviewed by first the School Assessment Committee (SAC), and then College Wide Assessment Committee (CWAC), the Dean, and the Vice Provost for Curriculum and Assessment. Assessment will be conducted in the Fall and Spring semesters, with a final report being submitted to the SAC and then the CWAC, the Dean, and the Vice Provost.

Alignment of Program Goals to All-College Goals

This table shows the alignment of the nine all-college goals with the three programmatic goals.

<i>All-college goals</i>	<i>Goal 1 (geo-knowledge)</i>	<i>Goal 2 (geo-skills)</i>	<i>Goal 3 (communication)</i>
Interdisciplinary Analysis	x	X	
Experiential learning		x	
Intercultural/International			
Critical Inquiry	x	x	
Communication			x
In-depth knowledge	X	x	
Understanding the world	x	x	
Awareness			
Engagement			

III. Program’s Institutional Context:

College’s Mission:

Ramapo College has four pillars of learning, two of which are foundational to this minor: Interdisciplinary Education and Experiential Learning. Another value important to the College is Sustainability, which is a theme running through the minor.

IV. Impact on Other Ramapo Undergraduate Programs

The minor will utilize existing courses; most are either required or elective courses in the Environmental Science major¹; the remainder are electives in the Environmental Studies² and Physics major. The required courses, and most of the electives, are offered once a year. Most of these courses usually have a couple of spare seats each time they are offered, which would accommodate students in the minor who are outside of these majors. These three majors have all indicated there would be no problem in accommodating a few extra students. Finally, as a minor, this program would not compete with any majors.

Currently, the Environmental Science major has two advisement tracks, the second of which was created for students seeking Earth Science content-area endorsement in teacher education. If this minor is approved, it will simplify the Environmental Science major by eliminating the “teaching” track. The Environmental Science faculty are eager to see this happen.

V. Program’s Need

Interest from Students

Every year for the past 10 years, a couple of students express interest in a geology / earth science minor. (These are usually Environmental Science or Environmental Studies students.) We have even, in the last 2 years, had 2 students leave Ramapo because we haven’t offered a geology

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(compared with \$34,750 for all occupations). Whilst an earth science *major* is not feasible at Ramapo, an earth science minor, particularly when combined with a science major, will open additional (and lucrative) doors for our students, both for employment, and in addition, give students a better chance of getting into earth science graduate programs (and thus, employment as a geoscientist). Some local graduate programs (e.g. Rutgers Newark, Columbia) accept students into geology MS programs with such a background.

Other Programs in NJ

- x NJCU, Montclair, Rider and Rutgers (New Brunswick) have minors in geology/geoscience/earth and environmental science. The only program similar in scope to the proposed minor is at Rider; the others are strictly geological.
- x Majors are listed in the table below. Given the broad scope of the proposed minor, the majors to be compared with are entitled Earth Science, which are William Paterson and Kean.

VI. Anticipated Enrollment

Based upon unsolicited student interest expressed to date, we would expect 2-3 students per year enrolling in the minor, for a total of approximately 10-15 students at any one time.

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VII. Additional Resources Needed, First Five Years

Organization:

- x Home school: Theoretical and Applied Science
- x In collaboration with: Environmental Science, Environmental Studies, Physics
- x Proposed convening group: E. Rainforth (ENSC), C. Brisson (PHYS), H. Horowitz (ENST)

No additional faculty resources are expected to be needed. The required courses, and most of the electives, are all offered once a year, and typically have a small number (2-3) of spare seats which would accommodate the number of students who have expressed interest.

In terms of facilities, the new Geology Classroom in the renovated G-wing has ample space and facilities for the geology courses, and there is also a new geology faculty research laboratory, in the event that students opt to undertake a research project as one of their electives.

Therefore, it is not thought that any additional resources will be required.

VIII. Degree Requirements

Curriculum:

The minor will consist of 5 courses, 4 credits each (total: 20 credits). Course descriptions are appended on the last two pages.

Required courses

- GEOL 105 Fundamentals of Geology (lec/lab) [writing intensive]
- GEOL 326 Paleontology (lec/lab) [writing intensive]
- Either: PHYS 103 Introduction to Astronomy
- Or PHYS 345 Astronomy and Astrophysics I

Electives – select two from the following (one must be GEOL or ENSC)

- GEOL 327 Geology of New Jersey
- GEOL 333 Environmental Geology
- ENSC 405 Global Climate Change⁴
- GEOG 303 Water Resources
- PHYS 105 Meteorology
- PHYS 221 Environmental Physics
- A 4-credit 2-semester geology research project (2 credits of independent study each semester)

Sequencing:

- x GEOL 105 is the prerequisite course for higher-level GEOL courses and ENSC 405.
- x Fall courses: GEOL 326, PHYS 221
- x Spring courses: GEOL 105, GEOG 303, GEOL 333, ENSC 405. (GEOL 333 and ENSC 405 offered in alternate years.)
- x Summer courses: GEOL 327

⁴ ARC submission in progress to revise this course to become “ENSC 3xx Climate Change Science”.

Advisement information for the typical populations who have enquired about a minor:

1. ENSC majors seeking Earth Science certification:

Currently, we have an Earth Science advisement track within the Environmental Science major, which (in conjunction with the 4 year plan for the track) enables students to specialize in Earth Science at the upper level within the major. Because this advisement track was created solely for ENSC students wanting Earth Science certification, the track will be eliminated upon the creation of the minor, because it will no longer be needed. A benefit of the elimination of the Earth Science track in ENSC is that the catalog / degree audits will be simplified. (Note: for teaching, 30 credits of Earth Science are required.)

- Currently, students seeking Earth Science certification by following the Teaching Advisement Track have to take *two* additional earth science classes beyond the major in order to reach the 30 credits required for content certification. With the elimination of this track, students would choose appropriate Earth Science electives in the major, and would still need to take the two extra earth science classes to reach the 30 required credits for content certification.
- Students wishing to seek Earth Science certification with both the ENSC major and EarthSci minor would take *three* additional earth science classes beyond the major to complete the minor (because two of the required courses in the minor are also required in the major, and no more than two courses can double-count between the major and minor). Although this is one more course than if an ENSC student didn't want the mi

Program's impact on the College's other programs:

The Neuroscience minor is designed to augment majors and will not negatively impact other programs. The minor consists of courses already offered in Psychology, Biology and Chemistry, and we believe we not require additional resources. There are students who intend to take the required courses for the minor by the time they graduate even if the minor is not offered.

Program's need/Student demand:

Student Survey

A request to complete a brief online survey, which included a description of the proposed neuroscience curriculum was recently sent to most of the Psychology and Biology majors. One hundred thirty-four students completed the survey.

Students were asked several questions, including:

Q1. How would you best describe your area(s) of study? You can check or fill-in all that apply.

Q2. Which of the following courses do you think you will complete by the time you graduate, even if there is no official minor in neuroscience?

Results: Many biology students report that they will complete Introduction to Psychology and many psychology students reported that they will complete an introductory level biology class. Seventeen students indicated that they will complete 5 of the required courses by the time they graduate even if the minor is not offered.

Q3. Based on the five course requirement for the minor in Neuroscience described above, would you minor in this program if it were available?

Results: Sixty-four students indicated that they would minor in the program if it were available.
(Note: A small number of people checked off more than one choice for example "Maybe" and "Yes")

A cross-tabulation of the results from Q1 and Q3 shows more detail about those who indicated "YES".
Thirty-five of those who indicate they have a major in psychology and 29 of those who indicate they have a major in biology would minor in neuroscience if the program were available.

Several students have communicated their interest in the minor in unsolicited personal communications:

Hello,

I just wanted to say I think the proposal of a Neuro minor would be absolutely amazing! I just transferred to Ramapo from Scranton University where I was a Neuro/Psych double major. There aren't a lot of schools that offer Neuro so it would be a great addition for the school! I really hope this request goes through! I know a bunch of people would be interested, and it would increase the amount of students who apply here! I was just wondering how soon it would be implemented if it passes?

Thank you,
Natali Taglic

Opportunities for further education

The Minor in Neuroscience will provide students with the capacity to bridge connections with advanced educational opportunities in several academic and professional areas. Academically these students will be trained as critically thinking empiricists capable of analyzing data generated from work in areas as diverse as psychology, biology, cognitive science, behavioral genetics, and neurophilosophy. This background will better enable students to apply to masters and doctoral level programs in all of these and related academic areas. The Neuroscience Minor will also better prepare students to apply to schools of medicine.

Northeast Liberal Arts Institutions with a Neuroscience Major/Minor

Lafayette College
Drew University
Smith College

Muhlenberg College
Vassar College
Bates College

3. Development of proficient scientific literacy and analytical skill to critically evaluate the scientific merit of original research and scientific dissemination by popular and social media.

Assessment: Laboratory Exercises: Biol.. 101 or Biol. 110, Chem 115
Term Paper: Psyc 352, Psyc 353, Psyc 430

4. Demonstrate effective communication about neuroscience in both written and oral form.

Assessment: CEC Psyc 352, 353, 430
Laboratory Exercises: Biol.. 101 or Biol. 110
Term Papers Psyc 352, Psyc 353
Exams: Psyc 209, Psyc 352, Psyc 353, Psyc 430
Presentations: Psyc 352, Psyc 353
Class Discussions Psyc 430

These direct measures of assessment are currently in use for all noted courses and are inclusive in the routine program assessments of the Psychology, Biology and Chemistry. An Assessment Plan for each academic year will be submitted early in the Fall semester for review by the School Assessment Committee, College Wide Assessment Committee, the Deans of SSHS and TAS and Vice Provost for Curriculum and Assessment. The Assessment will be executed across the Fall and Spring semesters with the final report submitted to the above listed groups and individuals. Assessment reports are due late Spring.

Alignment Program Goals to College Goals

College Goals	Neuro. Goal 1	Neuro. Goal 2	Neuro. Goal 3	Neuro. Goal 4
Interdisciplinary Analysis	x	x	x	x
Experiential learning	x	x	x	
Intercultural/International		x		
Critical Inquiry		x	x	x
Communication		x	x	x
In-depth knowledge	x		x	x
Understanding the world		x	x	x
Awareness				
Engagement				

Program's relationship to the College's mission and Strategic Plan, and the School's mission and/o goals:

Program's Relationship to College's Mission:

Ramapo College's mission states that it is dedicated to providing students with a strong foundation for lifetime of achievement and that the college is committed to academic excellence through interdisciplinary and experiential learning, and international and intercultural understanding. Interdisciplinary education is foundational to a minor in Neuroscience, as is a liberal education as defined by the AACU. The minor also reflects the value of student engagement by specifically offering courses that are characterized by critical examination, analysis, reflection, and problem solving.

Strategic Plan:

Goal 1 of the Strategic Plan seeks to "Advancing Academic Excellence and Engagement" through its General Education, major and free-standing minors programs. A minor in Neuroscience aligns with the strategic plan by integrating coursework from two schools, TAS and SSHS, to provide students with an interdisciplinary study of the human experience.

School of Social Science and Human Services' Mission:

The minor addresses several of the goals embedded within SSHS' mission, including an interdisciplinary learning environment, using social science perspectives to understand the study of mind, behavior and brain, and engaging students in critical thinking about enduring and emerging issues with the study of psychology, brain, and behavior.

Curriculum for the Neuroscience Minor – 5 Courses Total*

Required Courses (these should be completed first and may be prerequisites for some of the electives):

1. Introduction to Psychology (PSYC 101)
2. Introduction to Biology (BIOL 101) or Fundamentals of Biology I (BIOL 110)

Select at least 3 additional courses from this list:

Neuropsychology (PSYC 310)

Cognitive Neuroscience (PSYC 353)

Behavioral Neuroscience (PSYC 352)

Perception (PSYC 209)

Principles of Chemistry I (CHEM 115) or Bio-organic Chemistry Lec/lab (CHEM 205)**

Advanced Topics in Neuroscience and Philosophy (PSYC 430)**

* At least 1/2 of the courses fulfilling the minor must be distinct from the student's major. That is, three of the five courses must be distinct from the student's major. (1. Introduction to Psychology (PSYC 101) is a prerequisite for PSYC 209, 310, 352, 353, and 430.)

Introduction to Biology (BIOL 101): This course examines the development of biology as a science from the ancient world to the present. The course will examine unifying principles of biology such as genetic/evolutionary theory as central themes of modern biology. Representative organisms will be used to illustrate how organisms, using basic plans found widely in nature, are adapted to their environment. This course will emphasize biological science as a process for gaining information about the natural world using the techniques and understanding of 21st century science. Individual course sections may focus on aspects of biology such as biodiversity or human anatomy and physiology.

Course Attributes: GE-SCIENCE W EXPERIENTIAL

Prerequisites: None

Fundamentals of Biology I Lec & Lab (BIOL 110): An introduction to the principles of biological science. This first semester of a two-semester sequence will cover the cell from its chemical composition, structure, and function to the nature of information coding and transmission. This course also surveys the major phyla of animals, plants and fungi. Three hours of lecture and four hours of recitation/laboratory.

Required for some science majors. NOTE: Dissection of plant or animal material is carried out in the laboratory portion of this course. Please refer to the Student Handbook for the College's dissection policy.

Course Attributes: GE-SCIENCE W EXPERIENTIAL, WRITING INTENSIVE

Prerequisites: Must have at least D in [CRWT 102 - CRITICAL READING & WRITING II](#) This course can be taken concurrently

Neuropsychology (PSYC 310): This course is designed to introduce the student to the field of clinical neuropsychology. This course will review the anatomy and basic function of the brain, particularly that of the cerebral cortex. Major neuropsychological dysfunctions related to brain damage, as well as what neurological disorders can reveal about normal brain functioning, will be presented. Students will also gain an understanding of the typical assessment tools and procedures used for diagnosing neuropsychological disorders. Fulfills Category 6. (Formerly Category 2)

Prerequisites: (Must have at least D in [CRWT 102 - CRITICAL READING & WRITING II](#) This course cannot be taken concurrently AND Must have at least D in [PSYC 101 - INTRO TO PSYCHOLOGY](#) This course cannot be taken concurrently

Cognitive Neuroscience (PSYC 353): This course will be concerned with how brain activity and structure support cognitive processes. We will discuss the findings of researchers who have applied advances in neuroscience to the investigation of cognition, perception, memory, language and other high level cognitive processes. There will be a focus on understanding the methods used in cognitive neuroscience. Historical and cutting-edge research will be explored. Implications within the larger context of the field of psychology will also be considered. Fulfills Category 6 requirement. (Formerly Category 3)

Prerequisites: (Must have at least D in [CRWT 102 - CRITICAL READING & WRITING II](#) This course cannot be taken concurrently AND Must have at least D in [PSYC 101 - INTRO TO PSYCHOLOGY](#) This course cannot be taken concurrently

Behavioral Neuroscience (PSYC 352): (FORMERLY: PSYC 245) An introduction to the biological

other. Our basic question will concern the relations that exist between descriptions of the physical world, our brain, and our experience. We will investigate what modern research has to say about the way in which we experience color, object, space, motion and event perception. Aspects of the visual arts will be discussed in this context, both as employing perceptual principles and helping to reveal them. Fulfill Category 2 requirement. (Formerly Category 3)

Prerequisites: Must have at least D in [PSYC 101 - INTRO TO PSYCHOLOGY](#) This course cannot be taken concurrently.

Principles of Chemistry I Lec/lab (CHEM 115): Principles of Chemistry is a one semester course with lecture, recitation and laboratory experiences designed for students in the allied health fields. This course introduces the fundamental concepts of general chemistry integrated with the essential features of organic and biological chemistry. Topics covered include atomic structure, the periodic table, molecular and intermolecular bonding, chemical reactions, the structure, properties and behavior of simple organic molecules, molecular features of carbohydrates, proteins and lipids. The relationship between molecular structure and macroscopic properties are emphasized. Radioactivity, its effects and uses in biological systems are briefly examined. Principles of physics are embedded in the course where appropriate. Lab Fee.

Course Attributes: GE-SCIENCE W EXPERIENTIAL

Prerequisites: None

Bio-organic Chemistry Lec/lab (CHEM 205): This 4-credit Lecture and Laboratory course offers a comprehensive introduction to basic modern organic chemistry. It will predominantly be of interest to students majoring in biology or bioinformatics who do not require the traditional 2-semester organic chemistry sequence. Therefore students who do not plan on applying to med-school or grad-school can take this course instead of the CHEM 210/212 sequence. This course will introduce students to the principles of organic structure and nomenclature, functional group chemistry and stereochemistry, providing the language and theoretical foundations of organic chemistry. Emphasis will be placed on the synthesis of organic molecules, including the conversion of one class of organic compound to another. In addition, the properties of these organic compounds will be discussed. Organic chemistry is a multifaceted science that is central to other related sciences including biology, biochemistry and medicinal chemistry. The middle part of the course will build on the general principles and will include details on the synthesis and reactions of alcohols, aromatic compounds, aldehydes, ketones, carboxylic acids and their derivatives and amines. In addition, the course will include sections determining structure of organic compounds using analytical techniques such as Infra-Red (IR) and NMR spectroscopy. The course will conclude with sections on carbohydrates, amino acids, proteins, lipids and nucleic acids, subjects closely related to biology and biochemistry. The co-requisite Laboratory will provide students with the required experiential component, where students will perform experiments that put into practice the ideas discussed in the Lecture. Lab Fee.

Prerequisites: Must have at least D in [CHEM 112 - FUND CHEM II LEC/LAB](#) This course cannot be taken concurrently

Advanced Topics Psychology (PSYC 430): NEUROSCIENCE AND PHILOSOPHY: Psychology, born from the disciplines of Philosophy and Physiology, has long sought to provide insight into the nature of the mind. Some of the classic questions include: What is the relationship between the mind and the body? Is the mind the same thing as the brain or is it something else? How can mere thoughts cause things to happen in a physical universe? Is it merely a delusion on our part to believe that our thoughts matter in the grand scheme of the universe? Recent progress in Neuroscience is profoundly altering our conception of how we think, feel, decide, love and even reproduce. Therefore, Neurophilosophy is a recent sub-discipline arising from the intersections of neuroscience, philosophy and psychology.

Prerequisites: All sections of PSYC 430 require PSYC 303/PSYC 304 as prerequisites; students must also have junior/senior academic standing.