Preparing Science Majors for Transfer: Opportunities for Independent Research at the Community College

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Independent Research: Why Do It?

• To prepare students for research opportunities and requirements at four-year schools
  – Many science majors in four-year colleges and universities are required to do research.
  – Research is increasingly begun at the sophomore (even freshman) level.
  – Community college students are at a disadvantage when entering at the junior level without research experience.
Independent Research: Why Do It?

• To expose students to the REAL scientific method
  – Students are exposed to techniques and instrumentation not found in traditional lab courses.
  – There is no “right” answer – students employ critical thinking rather than rote learning.
  – Students design the experiments – no cookbook lab manuals.
  – Research projects introduce students to new ways of thinking about and doing science.
Opportunities for Independent Research in the Science and Engineering Department at RVCC

- Honors Option Courses
- Honors Independent Research Course
- Research at Rider University
- Capstone Courses
Honors Option Courses:
CHEM 212H Organic Chemistry II Honors

• Five Credit Course Embedded in Organic II
• Students (1-3) selected based on performance in Organic I
• Honors Research Project:
  – Replaces three-week Qualitative Analysis experiment and is worth 10% of final grade
  – Student picks a relevant topic at the beginning of the semester and does literature research to define the project and plan three weeks of experiments
  – Formal research paper due at the end of the semester
  – Poster presentation at the Science and Engineering Department Poster Session
  – Science Seminar optional
Honors Option Courses:
CHEM 212H Organic Chemistry II Honors

• Examples of Student Projects:
  – “A Comparison of the Concentration and Chemical Makeup of Pure and Imitation Vanilla Extract” (Maribel Santos)
  – “An Investigation of Environmentally Friendly Oxidation Reactions” (Brittany Velcko)
  – “Biodiesel: Preparation and Temperature-Dependence of the Viscosity” (Katrina Washington)
Independent Research Course:
SCI 210H Honors Independent Research

• Three Credit Course
• Instructor Compensated at Independent Study Rate
• Adaptable to Different Disciplines
• Description: In consultation with and approval of the faculty member, students select a research topic, perform a literature search, design and complete appropriate research. Students will be required to complete a formal paper detailing the research; including the purpose, methods, results and conclusions. Additional culminating experiences, as directed by the instructor, may include an oral presentation, a poster display at a local or regional conference, or submission of a research paper to a journal.
Independent Research Course:
SCI 210H Honors Independent Research

• Examples of Student Projects:
  – “Comparing Decaffeination Methods: Efficiency and Environmental Sustainability” (Justin Corbo)
  – “Analysis of the Degradation of Polylactic Acid Consumer Products into Lactic Acid Using Chemical, Bacterial, and Natural Compost Methods” (Tyler Hardy)
  – “DNA Sequencing and Bioinformatic Analysis of a Soil Sample from the RVCC Campus” (William Supplee, Daniel Whitehead)
  – “Mammalian Cell Cloning and Extraction of DNA from an Environmental Soil Sample” (Parth Dixit, Travis Downey, Jeramie Kerr, Lucas Onder)
Research at Rider University

• Partnership with the Chemistry, Biochemistry, and Physics Department at Rider University
  – Students (1-2) selected by RVCC faculty each spring
  – Minimum CHEM 212 Co-Requisite
  – Students register for SCIE 210H with Rider University research advisor listed as adjunct instructor
  – Independent Study compensation covers cost of materials
  – Liability Insurance Certificate issued annually by RVCC based on three-year Memorandum of Understanding drafted by Rider
Research at Rider University

• Examples of Student Projects:
  – “Synthesis of Pyrrole Nucleosides” (Iryna Barbella and Brian Sulvinski with Professor Bruce Burnham)
  – “Testing the Mechanism of the Claisen Rearrangement” (Jackie Franzosi with Professor Danielle Jacobs)
Capstone Courses:
RVCC Honors College

• Students admitted into the Honors College at RVCC are required to complete a Capstone project
  – The work completed is equivalent to a 3-credit course
  – Project is expected to be completed independently under the guidance of a faculty member

http://www.raritanval.edu/academics/honors/index.html
Capstone Courses:
ENVI 201 Environmental Field Studies

• **Three Credit Course** (2 hrs. lecture, 2 hrs. lab)
• **Capstone Course for Environmental Science Major**
• **Description:** Students introduced to all aspects of the scientific research process, and gain hands-on experience with field methods in a variety of environmental subject areas, including soil, water, plant, animal and sustainability studies. Students design and conduct their own research and create a poster presentation and final report in the format of a standard scientific paper.
• **Types of Projects:**
  – Student-Driven Projects
  – Grant-Driven Projects
  – Community Partner-Based Projects
Capstone Courses:
ENVI 201 Environmental Field Studies

• **Modular Course Design**
  – Structured activities giving exposure to different stages of research process
  – Purpose – to students with less experience or focus (i.e., not self-selected researchers)

• **Examples**
  – Library Research
    • Effects of Plastic Marine Debris
  – Study Design
    • Arsenic Contamination in Parks and Playgrounds
  – Field Methods/Data Collection
    • Invasive *Miscanthus* Surveys, Amphibian Road Crossing Surveys, Endangered Plant Surveys, Reptile Surveys, Recycling and Waste Reduction, Energy Audits
  – Data Entry and Analysis –
    • Well Water Contamination Data
Capstone Courses:
ENVI 201 Environmental Field Studies

• **Final Project** – 3 Options
  – Use class project data (“Bookend” class data)
  – Variation of class project (e.g., study different place/species)
  – Entirely independent project

• **Examples of Community Partner-Based Projects**
  – Amphibian Road Crossing Surveys (Conserve Wildlife Foundation of NJ)
  – Invasive Plant Species Surveys (NJ Invasive Species Strike Team)
  – Analysis of Well Water Contamination in the Raritan Watershed (Raritan Headwaters Association)
  – Stream Monitoring/Benthic Macroinvertebrate Sampling (Raritan Headwaters Association)
Capstone Courses:
ENVI 201 Environmental Field Studies

• **Examples of Student-Driven Projects**
  – Tracking Inland Sources of Plastic Marine Debris in the Raritan Watershed (Blaire Langston)
  – Forest Development in the Floodplain of the Raritan River at Raritan Landing, NJ (Kit Bassett)
  – Assessing Wildlife Habitat Use in an Agricultural Landscape in Hunterdon County, NJ (Deidre Supple)
  – Use of Arsenic-Treated Wood in Public School Playgrounds and Parks (Heidi and Judy Gatsch)
  – Energy Audit of the West Building, RVCC Campus (Tamer Shabani)
  – Surveys of Mammalian Fauna on RVCC Campus (Pat Downs)
  – Surveys of Winged Monkeyflower in Floodplain Forests on the Raritan River (Jacqueline Schulack)
  – Assessing Air Quality on the Appalachian Ridge Using Indicator Lichen Species (Heidi Ragsdale)
  – Lead Contamination from Shotgun Pellets at Spruce Run Reservoir Firing Range (Daniel Klawunn)
  – Interpretive Guide to the Trees of Round Mountain (Ryan Tallmadge)
Capstone Courses:
ENVI 201 Environmental Field Studies

• **Examples of Grant-Driven Projects**
  – Explaining the Absence of Native Shrub Flora in the Ridgewood Reservoir, Queens, NY (Allison)
  – Surveys for Swamp Pink in the Black River Wildlife Management Area (Jason Cesta)
  – DNA Extraction and AFLP Analysis of Endangered Mountain Mint Species in NY and NJ (Maribel Santos, Travis Downey)
  – Surveys and Monitoring of Endangered Plant Species in NJ (Kit Bassett, Blaire Langston, Tyler Hardy, Mike Ezawa, Matt Singer, Sean Driscoll, Jessica Bauer)
  – Design and Development of a Green Roof on Hunterdon Hall, RVCC Campus (Frank Dahlhaus)
Opportunities to Present Independent Research in the Science and Engineering Department at RVCC

• Research Papers
• In-Class Presentations
• Honors Science Seminar
• Department Poster Session
• Honors Colloquium
SCI 128H Honors Science Seminar

- Three Credit Honors Course
- Instructor Compensated at the Independent Study Rate
- **Description:** This is an interdisciplinary course based on the Science and Engineering Department’s Science Seminar series. By attending the seminars, students will be exposed to current research, breaking science news, and historical backgrounds in a variety of fields. Each student will present a short seminar on a topic of his or her choice.
SCI 128H Honors Science Seminar

• Weekly series of 80-minute seminars on a variety of topics
• Open to the college community and the general public

• Given by:
  – RVCC faculty (full-time and adjunct)
  – Faculty from neighboring colleges
  – Scientists from government and industry
  – Students who register for the course
  – Students who present research results
SCI 128H Honors Science Seminar

• **Examples of Seminar Topics from this Semester:**
  – The Making of an Egg: Recent Breakthroughs in Scientific Technology and the Implications for Human Assisted Reproduction (RVCC Professor Melanie Lenahan)
  – Ecology Experiences: My Time After RVCC (RVCC Graduate Tyler Hardy)
  – Endangered Bird Species in NJ (Emil DeVito, NJCF)
  – What is the World Made of? An Introduction to Elementary Particle Physics (RVCC Professor Nader Copty)
  – Archimedes' Method of Indivisibles (RVCC Professor Emil Sargsyan)
SCI 128H Honors Science Seminar
Science and Engineering Department Poster Session

• First held in April 2012 with more than 20 posters
• More than 30 students participated
• Independent Research and Class Projects
• Bio-Chem Club and Engineering Club Presentations
  – Titanium Anodization
  – Exploring Surface Tension with Paper Clips
  – Moments of Inertia
  – Hand-Washing: A Closer Look
  – Getting Messy with the Bio-Chem Club
  – A Pasta Bridge
  – Enhancing the RVCC Engineering Experience
Science and Engineering Department
Poster Session
Honors Colloquium

• A student from any discipline can be recognized for their work and offered the opportunity to present at the college-wide Colloquium
• Students receive a plaque and gift certificate for their efforts
• Several science students have presented their independent research projects at this venue
Additional Benefits

• Honors projects used to develop experiments for traditional lab courses
  – The Synthesis and Analysis of Biodiesel
  – A Greener Oxidation Reaction: The Oxidation of Benzhydrol to Benzophenone Using Household Bleach

• Research applied to MS degree programs
  – Eva Gartska (MS Biotechnology, Kean University)
  – Nicholas Osto (MS Biotechnology, University of Pennsylvania)
  – David Sierra (MS Biotechnology, Kean University)
Additional Benefits

- DNA sequences published in GenBank
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