VERMONT COMMONS SCHOOL SCIENCE

'98 Science Award:
Morrigan McCarthy '00

'99 Science Award:
Asher Burns-Burg '01

'00 Science Award:
Nissa Kauppila '01

Naturalist Certificate:
Matt Brown (2000): The EcoMachine Workshop

Project: Matt designed and taught a semester-long Research & Service class on EcoMachine design. This class culminated in a workshop run by VCS students for area Vermont High School teachers.

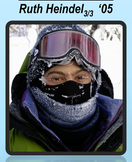
'01 Science Award:
Matt Brown '01

'02 Science Award:
Ruth Heindel$_{1/3}$ '05

'03 Science Award:
Ruth Heindel$_{2/3}$ '05

'04 Science Award:
Emily Unger$_{1/2}$ '06

'05 Science Award:
Ruth Heindel$_{3/3}$ '05



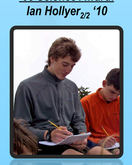
Naturalist Certificate:
Emily Unger (2004): Living Vermont Journal

Project: Emily researched the history of field journals, as far back as pre-Colombian native Americans, at the University of Vermont. She incorporated the lessons she learned in a field guide of native Vermont flora & fauna, producing a 60-page document which has been used as part of VCS' curriculum.

'06 Science Award:
Emily Unger$_{2/2}$ '06

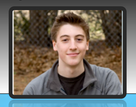
'07 Science Award:
Ian Hollyer$_{1/2}$ '10

'08 Science Award:
Ian Hollyer$_{2/2}$ '10



Naturalist Certificate:
Ian Hollyer (2010): Lewis Creek Hydrology

Project: Ian worked with the VT Agency of Natural Resources, the Lewis Creek Association, and local land-owners as he performed a year-long chemical analysis of one of our local watersheds. By examining the effect of land use on a fragile riparian ecosystem, Ian was able to provide some well-researched management solutions to all stakeholders.



'09 Science Award:
Sarah Mueller '12

'10 Science Award:
Joe Congdon '10

'11 Science Award:
Schuyler Cowan '11

Naturalist Certificate:
Ruth Heindel (2012): Naturalist

Project: Ruth has, and will continue to, live the life of the naturalist as much as anyone ever associated with VCS. Ruth has lived and worked in the Arctic Circle, and left Vermont to begin her Graduate research in Greenland and Antarctica.

'12 Science Award:
Nora Hill '15

'12 Vermont Academy of Science and Engineering: Science Teacher of the Year
Peter Goff

Naturalist Certificate:
Gabe Mantegna (2013): fMRI Research

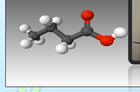
Project: Gabe joined a UVM medical research team, utilizing cutting edge technology that allowed him to visualize a working human brain using fMRI. Functional MRI allows us to build 3D images, detailing how the brain responds to specific stimuli. In particular, Gabe looked at the effect of listening to music as a way to mitigate post-operative and chronic pain.

'13 Science Award:
Mia Jager '13

'14 Science Award:
Eli Hulse '15

Naturalist Certificate:
Nora Hill (2015): Fatty Acids as measures of energy flow

Project: Nora spent the better part of two years working in two UVM labs; Dr. Jason Stockwell's aquatic ecology lab in the Rubenstein school, and Dr. Janna XX organic chemistry lab. Nora helped the research team explain the role of phytoplankton blooms on energy flow in lakes. Nora used gas chromatography to isolate fatty acids as a way to unveil the flow of energy through the trophic web.

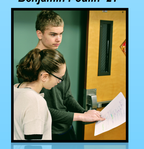


'15 Science Award:
Mikhal Yudien '15

'16 Science Award:
Henry Harder '17

'17 Science Award:
Beckett Richardson '18

'18 Science Award:
Benjamin Poulin '21



Systems Science Learning Project
*Rob Skiff & Peter Goff and multiple Science and R&S classes**

The SSLP was a joint VCS – Nanjing Normal Institute & University project that ran from 2004-2007. We developed, delivered, and managed curriculum for a 3-year project that teamed VCS students with Chinese students on cooperative system science modeling projects (which included reciprocal travel). While in Vermont, the American & Chinese students presented at a modeling conference (a joint MIT / WPI conference in Worchester run by the Creative Learning Exchange), for UVM professors, local experts/stakeholders, and a research group from Boeing Phantomworks. As a result of this collaboration, Rskiff and PGoff were invited to a Complex Systems in Education conference in Shanghai, China, in 2007 where we presented the results of the project.

STELLA
Systems Thinking for Education and Research

**special acknowledgements to the following students: Emily Decatur ('11), Ian Hollyer ('10), Ted Retzloff ('11), and Ruby Russell ('10)*

Summer Research: NSF-funded Whirling Disease Project
Shana Wolfstein '11, Sarah Mueller '12, & PGoff

Through two National Science Foundation grants totaling $30,000, PGoff was able to secure positions for himself and two VCS students to take part in a joint UVM-Montana State University project to examine a deadly trout-disease; Whirling Disease. The VCS team developed a STELLA model of the complex 2-host disease system which the girls presented to the MSU Ecology faculty during our field & lab work in Bozeman. Working side-by-side with undergraduates, graduate students, postdocs, and UVM and MSU faculty, the VCS team took part in both field and lab work. Working with UVM professors Dr. Donna Rizzo (CEMS) on the modeling component and Dr. Lori Stevens (Bio) on the genetic-sequencing component of the project, we were also authors on a paper presented by Dr. Rizzo at the American Geophysical Union annual meeting in San Francisco.

Summer Research: EPSCoR RACC
Aidan Villani-Holland '14, Nora Hill '15, & PGoff

Through Vermont's federal EPSCoR grant program, the VCS team started a year-long research project as part of the Research on Adaptation to Climate Change (RACC) program. Throughout the summer and fall, the team collected stream data at the Huntington River. This data was used to build a hydrology STELLA model of the system presented at UVM's annual undergraduate research day in the spring of '13, for which the students won the Best Student Poster award!

Summer Research: NSF-funded Chagas Disease Project
Anna Hulse '17, Henry Harder '17, Lincoln Pierce '16, & PGoff

Through two National Science Foundation grants totaling $30,000, PGoff was able to secure positions for himself and three VCS students to take part in a joint UVM-Loyola University and Guatemala University project to examine a deadly multi-host system effecting millions of people in the Americas. The VCS team developed a village-scale STELLA model of the complex 3-host disease system. The team worked side-by-side with a multinational group of undergraduates, graduate students, and postdocs. Working with UVM professors Dr. Donna Rizzo (CEMS) on the modeling component and Dr. Lori Stevens (Bio) on the genetic-sequencing component of the project, we were also authors on a paper presented by the students at the American Geophysical Union annual meeting in San Francisco.

AP Environmental Science Web-CT course
Peter Goff and VCS AP Environmental Science Course

After receiving a grant from the Collage Board™ in collaboration with Dr. Alan McIntosh (UVM, Rubenstein School of Natural Resources), Peter Goff and several VCS classes designed the laboratory component of an AP Environmental Science course. The labs, written by Goff and Manske, were performed via closed-circuit TV by VCS students. These programs were used by small schools throughout New England who didn't have access to appropriate lab materials, techniques, and/or instructors.

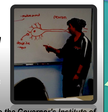
KEEP CALM and STUDY SCIENCE

**special acknowledgements to the following students: Emily Alger ('03), Naomi Heindel ('03), and Asher Burns-Burg ('01)*

Summer Research: EPSCoR – Genetic Sequencing
Mikela Boudette '11, Schuyler Cowan '11, Leslie Gadway '12, Leynah McGarghan '11, & PGoff

Through Vermont's federal EPSCoR grant program, the VCS team worked in Dr. Sarah Helms-Cahan's DNA sequencing lab to pilot a lab protocol that would be used in Vermont High Schools. The girls collected ants from field sites, isolated their DNA, amplified the DNA (to get enough genetic material to use with the sequencing protocols), and finally learned to enter the information in the national DNA databank to successfully identify the species. Dr. Helms-Cahan brought her team of graduate students to VCS the following fall and with the help of Leslie (pictured), VCS students were the first to attempt (successfully) the DNA sequencing protocol.

Summer Research: Artificial Neural Networks
Lex Jackson '12 & PGoff



Alexis Jackson was awarded a paid internship in Dr. Donna Rizzo's lab in the Environmental Engineering Department at UVM to research Artificial Neural Networks (ANNs). Lex taught herself the MatLab programming language to build her own pattern-recognition ANN. Over the course of the internship, she created an hour-long presentation with the goal of having Dr. Rizzo co-present the work with her to the Governor's Institute of Vermont Math Academy. However, Lex demonstrated such a strong mastery of the material, that Dr. Rizzo asked her to present the work on her own (which she did, to rave reviews).

Summer Research: Artificial Neural Networks
Eli Hulse '15 & PGoff

Eli followed in Alexis Jackson's footsteps in Dr. Donna Rizzo's lab in the Environmental Engineering Department at UVM, again doing original Research on Artificial Neural Networks (ANNs). Eli taught himself the MatLab programming language to build his own pattern-recognition ANN, which was used as part of an on-going research project for several of Dr. Rizzo's undergraduate and graduate students. Eli presented his work to the Governor's Institute of Vermont Math Academy.

Science Mission

The goal of the Vermont Commons School Science program is to produce Naturalists, scientists who understand the environment and their place within that system. The VCS science curriculum uses STEM principles and practices to help students understand the connections among Chemistry, Physics, and Biology. The guiding principles of the department are two-fold: to create naturalists who will be able to use the Scientific Method to identify the keystone questions within a particular system, answer them thoughtfully, and then act upon the new knowledge; and that naturalists graduate from VCS confident in their scientific literacy and ability to apply technical knowledge and critical thinking in their roles as engaged citizens in their community.
(Peter Goff & Dr. Donna Rizzo (UVM, CEMS) with further contributions by Hans Manske, Dr. Ruth Heindel, Dr. Mark Keegan, and Kris Mohlman)

Naturalist Certificate

The Naturalist Certificate of Concentration recognizes students who have met the goals of the VCS Science Mission Statement of producing Naturalists. These students develop year-long independent study projects in the laboratory or field with a clearly defined benefit to the community. Upon completion of the work, students present their project to the community and defend it to the department (in the style of Graduate research, and their transcript will note their progress towards completion of the certificate). Naturalists who have completed the requirements of the program will be recognized at their graduation.

Grade	Fall Semester	Spring Semester
6th	The Scientific Methods	
7th	The Living Vermont	
8th	Engineering Thought	Experimental Design
9th	Chemistry I: Matter & Energy	Biology I: Cellular Biology & Anatomy
10th	Physics I: Mechanics	Biology II: Evolution
11th	Chemistry II: Stoichiometry	Physics II: Light & Electricity
12th	Senior Electives I	Senior Electives II

Senior electives:
Animal Behavior
Forensics
Human Physiology
Marine Biology / Oceanography
Neuroscience
Space Science
Zoology
...& others added yearly

A Few VCS Alum in STEM

Barker, Ben. BSN Nursing (MGH Institute of Health Professions). Registered Nurse, *Boston Children's Hospital*

Carrara, Isabella. BS Physician Assistant (BU). pursuing MS

Fargo, Griffen. BS Game Design (Champlain). Software Developer, *Alley.co*

Harder, Henry. Computer Science (Columbia). Software Engineer/co-founder, *Paradigm Market*

Heindel Naomi. BA Earth Science (Dartmouth), MESc Environmental Science (Yale School of Forestry). Director of Field Education, *Teton Science Schools*

Heindel, Ruth. BS Geological Sciences (Brown), PhD Earth Sciences (Dartmouth). Postdoctoral Scholar, Institute of Arctic and Alpine Research, *UC Boulder*

Hinds, Elijah. BS Mechanical Engineering (RPI). Manufacturing Engineer, *Global Foundries*

Lagasse, Carly '09. BS Nursing (Castleton)

Leff, Asher. PhD Materials Science & Engineering (Drexel University). Research Scientist, *U.S. Army Research Laboratory*

Lemay, Tyler. MD (UVM). Emergency Medicine residency, *Duke University Hospital*

Letovsky, Dan. MS Cybersecurity (UMUC). Lead Technologist, *Booz Allen Hamilton*

Sadler, Henry. BS (Eckerd). Science Teacher, *Admiral Farragut Academy*

Sears, Tim. BA Math & Computer Science (Cornell). Software Engineer, *Google*

Wolfstein Shana, BA Molecular and Cellular Biology (Yeshiva University), Doctor of Pharmacy Candidate, *Touro College of Pharmacy*