RECORD OF ACADEMIC ACHIEVEMENT

The Evergreen State College - Olympia, Washington 98505

OFFICIAL TRANSCRIPT DOCUMENT

Johnson, Tyler Ta — A00423349

Last, First Middle — Student ID

TRANSFER CREDIT:

Start	End	Credits	Title
04/2017	06/2019	39	**Tacoma Community College**
09/2017	06/2018	23	**San Jose State University**

EVERGREEN UNDERGRADUATE CREDIT:

Start	End	Credits	Title
09/2019	06/2020	38	**Integrated Natural Science** *15 - General Biology I, II and III with Laboratory* *15 - General Chemistry I, II and III with Laboratory* *4 - Historical Geology* *4 - Fundamentals of Soil Science*
09/2021	03/2022	32	**Environmental Biology and Chemistry** **11 - Organic Chemistry I and II with Laboratory* **4 - Organic Chemistry: Instrumentation and Spectroscopy* **5 - Microbial Ecology with Laboratory* **4 - General Microbiology with Laboratory* **3 - Environmental Microbiology with Laboratory* **3 - Biogeochemistry and Bioremediation with Field Methods* **2 - Environmental Chemistry*
03/2022	06/2022	16	**Field Ecology** **4 - Ecological Research in Managed Forests* **4 - Field Research in Grazing Systems* **4 - Applied Field Research in Steppe Habitats* *4 - Ecological Statistics*
06/2022	09/2022	16	**WSDOT Wetlands Monitoring Internship** **16 - Applied Wetland Monitoring Science*
09/2022	12/2022	16	**Temperate Rainforest Biogeochemistry and Ecophysiology** **6 - Forest Ecology* **6 - Biogeochemistry* **4 - Remote Sensing and GIS: Geographic Information Systems*

Cumulative

180 Total Undergraduate Credits Earned

Johnson, Tyler Ta — A00423349
Last, First Middle — Student ID

September 2022 - December 2022: Temperate Rainforest Biogeochemistry and Ecophysiology

16 Credits

DESCRIPTION:
Faculty: Dylan Fischer, Ph.D. and Carri LeRoy, Ph.D.

Temperate rainforests are important ecosystems in the Pacific Northwest and other coastal landscapes around the world. This type of ecosystem supports complex interactions among constituents of the atmosphere, the forest, and the underlying geology. By focusing on the biogeochemistry and nutrient cycling of the forest, we worked to understand the interplay between the biotic and abiotic components of these ecosystems. We examined global and local patterns in temperate rainforests, global carbon pools and fluxes, climate change, biogeochemistry and origin of elements, geographic trends, soils and soil chemistry, and research history.

Our lectures and field labs emphasized the temperate rainforests of the Olympic Peninsula and Cascades Volcanos with two multiple-day field trips exploring forests in these locations. Students acquired experience with various sampling techniques that are used to measure carbon (aboveground tree carbon storage) and carbon flux (soil respiration and decomposition) in forested ecosystems in lab exercises in forest biogeochemistry. Students adopted long-term research plots in the Evergreen Forest Reserve and visited plots weekly for sampling and monitoring. Students gave final presentations incorporating various ecological and biogeochemical measurements from their research plots.

Readings and guest lectures introduced students to major ecological and biogeochemistry issues for temperate rainforests. Students read the textbook *Biogeochemistry: An Analysis of Global Change* by Schlesinger and Bernhardt, and we covered topics in biogeochemical processes and reactions, including: Origins of the elements, solar system, and Earth; Atmospheric structure and processes; Rock weather and soil development; Terrestrial ecosystem carbon cycling; the Global carbon cycle; and Riparian ecosystem function. Quizzes and exams demonstrated knowledge of concepts and techniques.

Seminar discussions focused on reading a major biogeochemistry text, two seminar books (*Not Just Trees* by Jane Claire Dirks-Edmunds, and *Hidden Forest* by Jon Luoma), and understanding scientific articles from the primary literature. Each student developed a scientific research proposal, either independently or in a small collaborative group. Students gave final presentations on their research proposals and some will implement these projects in the winter quarter.

Students learned concepts in remote sensing and geographic information systems (GIS) analysis through reading a text (*Essentials of Geographic Information Systems* by Campbell and Shin), lectures, and hands-on computer labs in ArcGIS Pro and ArcGIS online. Students learned about raster and vector data, and a variety of methods for manipulating and analyzing spatial data. Students learned cartographic techniques for map layouts and how to create both WebMaps and interactive StoryMaps for sharing geographic data. Students learned to download data from multiple sources and upload it to ArcGIS Pro, collect their own GPS data in the field, navigate to remote forest plots using GPS, collect data using Survey123, and learned how to upload GPS data into a GIS to do spatial analyses. Students learned to clip rasters, convert rasters to polygons, pairwise clip, select by attributes, export features, change symbology, modify attribute tables, calculate geometry, enter X/Y data, delineate watersheds, create buffers, digitize features, modify features, georeference images, create charts from attribute tables, calculate descriptive statistics, calculate zonal statistics, interpret spatial analyses, create Map Layouts, export WebMaps, and create StoryMaps. Finally, students worked independently to complete a final GIS project either associated with their project proposals or an area of interest in forest ecology. This involved finding and importing data, running analyses, and creating final maps or StoryMaps.

Johnson, Tyler Ta — A00423349
Last, First Middle — Student ID

EVALUATION:
Written by: Dylan Fischer, Ph.D. and Carri LeRoy, Ph.D.

It was a distinct pleasure to get to work with Tyler (Maria) in this final quarter at Evergreen! In the Forest Ecology and Biogeochemistry sections of the program, Maria's demonstration of learning was excellent on quizzes and a final exam. Maria's demonstration of knowledge and engagement in seminars evaluating published books and scientific journal articles was more challenged. Theoretical work was paired with learning advanced field and laboratory methods for forest science and biogeochemistry. Students were asked to apply techniques for measurement of forest carbon and soil carbon dioxide efflux in long-term research plots. They then compiled those measurements into a forest carbon budget. Maria's final presentation on carbon flux in a long-term forest measurement plot was generally good. Maria's work in our regular field labs (which evaluated data integrity and critical analysis) was also generally good. Additionally, Maria completed a series of workshops demonstrating certification to operate a Perkin Elmer 2400 Elemental Analyzer for the measurement of carbon and nitrogen in plant and soil samples. This training required many hours spread over three discrete sessions, and in the final session students were required to “train the trainer” and complete analysis on a sample independently.

A research proposal completed throughout the quarter allowed students to apply their learning in forest ecology and biogeochemistry proactively, while deepening their learning in a specific area of forest ecology. Maria's research group completed a very nice proposal examining correlations between forest understory plant species community composition and large woody debris in temperate rainforests. This proposal had a robust research design, an excellent literature cited section, and a nicely developed expected findings section. Maria's final presentation on this group research proposal was generally good.

Our work in GIS gradually increased in complexity through the quarter. Students were tasked with working with vector and raster data, conducting complex analyses, creating shareable story maps and georeferenced pdfs, and creating a final project integrating their learning. In this work Maria's combined performance on weekly labs was outstanding. On a final GIS project Maria did good work.

Finally, this quarter was a unique opportunity to blend biogeochemistry, forest ecology, and GIS in field and remote settings. Our approach emphasized independence in student learning. Forest Science and Biogeochemistry are inherently interdisciplinary, and students dealt with that component in a hands-on way. In this context, successful completion of this program should be seen as a major and unique accomplishment. Maria should be very proud of all work completed this quarter in forest ecology, biogeochemistry, and GIS.

SUGGESTED COURSE EQUIVALENCIES (in quarter hours) TOTAL: 16

*6 - Forest Ecology
*6 - Biogeochemistry
*4 - Remote Sensing and GIS: Geographic Information Systems

* indicates upper-division science credit

Johnson, Tyler Ta — A00423349
Last, First Middle — Student ID

June 2022 - September 2022: WSDOT Wetlands Monitoring Internship

16 Credits

DESCRIPTION:
Faculty: Lalita Calabria, Ph.D.

The **WSDOT Wetlands Monitoring Internship** was offered in cooperation with the Washington State Department of Transportation (WSDOT). As a participant in this program the student gained hands-on experience in collecting environmental data from WSDOT wetland mitigation sites. Over the eleven-week course, they learned to use a variety of quantitative and qualitative techniques to conduct environmental monitoring. Fieldwork included conducting surveys of vegetation, hydrology and wildlife. The greatest percentage of the internship was devoted to learning vegetation sampling, collection, and identification techniques. The intern used basic elements of sampling design to create and implement vegetation-monitoring strategies on several WSDOT wetland mitigation sites. In addition, the student learned WSDOT protocols to collect plant species that they are unable to identify in the field. These specimens were then identified using a dissecting scope and technical plant key. The required texts for the internship included: *Flora of the Pacific Northwest* (Hitchcock and Cronquist), *How to Identify Plants* (Harrington and Durrell), and *How to Identify Grasses and Grasslike Plants* (Harrington). Students earning graduate credits contributed to a weekly plant conservation discussion seminar focusing on peer-reviewed literature. The seminar was optional for students earning undergraduate credits.

EVALUATION:
Written by: Lalita Calabria, Ph.D.

In a recent letter, field supervisor Sean Patrick, Manager for the Wetland Monitoring Team, provided me with the following information on what Maria accomplished during the internship at the Washington State Department of Transportation.

"Maria Johnson's work through all phases of the internship program was excellent. Maria was a motivated field biologist, ready to work hard even under difficult field conditions. Maria was punctual and prepared for work. Maria's attention to detail, high productivity, willingness to take on optional tasks, and sense of humor made it enjoyable to work with her in the field and laboratory. Maria demonstrated the ability to work both in an individual and collaborative work setting. Maria's work was typically completed in an efficient, accurate, and thorough manner. Maria's broad understanding of our process and daily preparedness allowed Maria to often provide suggestions that improved our sample designs in the field.

Maria Johnson came into the internship program with some prior botanical knowledge. During the summer, Maria enhanced their technical plant skills and willingly helped other students work with dichotomous keys. Maria's hard work and persistence usually resulted in correct plant identifications. Although Maria missed the first herbaceous plant test on an excused absence, when tested on the common herbaceous and woody plant species found in wetlands and wetland buffers, she demonstrated her plant ID knowledge with an excellent score on the woody plant test and an acceptable score on the second herbaceous plant test.

Maria Johnson worked as part of a three-member team to produce a written report and oral presentation for one of the compensatory mitigation sites surveyed this year. Maria presented on the wildlife observations and other qualitative data collected on-site in order to supplement the quantitative sampling data. She contributed substantially to the creation of the presentation slides and formatting of the report.

Maria Johnson's work performance and desire to learn made them a valued member of our monitoring team. She was an efficient and diligent worker, who battled through allergies and difficult field conditions

Johnson, Tyler Ta — A00423349
Last, First Middle — Student ID

all summer with no complaints and a positive attitude. She also demonstrated a particularly strong grasp of the statistics portion of the training. It was a pleasure to work with Maria this summer.

The data collected by Maria Johnson and other student interns will be used to produce WSDOT annual monitoring reports. These reports are distributed to WSDOT regional offices and to federal, state, and local regulatory and resource agencies as part of WSDOT mitigation obligations."

Clearly, this has been a valuable learning experience for Maria. Maria gained experience and completed an important job for WSDOT.

SUGGESTED COURSE EQUIVALENCIES (in quarter hours) TOTAL: 16

*16 - Applied Wetland Monitoring Science

* indicates upper-division science credit

Johnson, Tyler Ta — A00423349
Last, First Middle — Student ID

March 2022 - June 2022: Field Ecology

16 Credits

DESCRIPTION:
Faculty: Dylan Fischer, Ph.D., Mike Paros, DVM

This program focused on intensive group and individual field research on current topics in ecological science, and is designed as a capstone experience for science students. Potential study topics included ecosystem ecology, effects of forest management, ecological restoration, grazing ecology, plant community ecology, insect-plant interactions, and disturbance ecology. Students were expected to intensively use the primary literature and student-driven field research to address observations about ecological composition, structure, and function. Multiple independent and group research projects formed the core of our work in local forests of the South Puget Sound lowlands, prairies, and sagebrush steppe habitats. Students were expected to hit the ground running, and they developed research projects in short time periods as brief as 1-2 weeks each.

Through a series of short, intensive field experiences and workshops, students were supported to hone their skills in observation, developing testable hypotheses, and designing studies to test those hypotheses. We especially focused on field techniques and approaches related to measuring plant communities. Students participated in a multiple-day field trip to eastern Washington (The Wild Horse Wind Farm). Research projects were formally presented by groups and individuals at the end of the quarter. Finally, student research manuscripts were created throughout the quarter, utilizing iterative peer and faculty feedback and opportunities for revision. We emphasized identification of original field research problems, experimentation, data analyses, oral presentation of findings, and writing in scientific journal format.

A series of labs in ecological statistics provided students hands-on opportunities to combine theory in statistics with practice for their own datasets. Students were also assessed on their understanding in descriptive, parametric, and multivariate statistics using the programs JMS (SAS inc.), JASP (and R-based GUI), and R/R-Studio. Finally, students presented analyses and wrote methods and results of their statistical analyses in individual first-author manuscripts.

EVALUATION:
Written by: Dylan Fischer, Ph.D.

Maria (Tyler) was a full participant in the program, field data collection, and in the development of field research projects. Below, details of each project are presented in separate paragraphs, followed by a paragraph summarizing Maria's applied and lab-based learning in ecological statistics.

For the first of two research projects this quarter, Maria played a leadership role in a project comparing pine sapling growth and seed sources in a reforested clear-cut near Olympia, WA. The project keenly took advantage of an unintentional assisted migration experiment where ponderosa pine trees (*Pinus ponderosa*) sourced from dry east-cascades forests were planted alongside *P. ponderosa* seedlings sourced from populations on the wetter west-side of the cascades. Due to climate change, there is a significant gap in understanding which seed sources will perform best in the future as wetter west-side forests become drier. Accordingly, the group compared the trees with implications for assisted migration. They also compared *P. ponderosa* seedling growth to that of the more common west-cascades species *P. monticola*. The group worked well together in the field, measuring detailed characteristics of nearly 100 seedlings (including leaf area, yearly growth based on whorl production, height, and diameter). The group continued to work well together in analyzing the data and preparing for a series of presentations and multiple drafts of a manuscript documenting patterns where east-side seed sources demonstrated longer leaves and taller heights. They also found larger girth in west-cascades *P. ponderosa*, and this

resulted in some interesting discussion about the physiological indicators of long-term survival and productivity. The final presentation and paper were both good, and I was impressed how well the group initially stuck to the required format for the manuscript.

In a second field research study Maria participated in a study comparing camas abundance and flowering across a gradient in surface rock in a western Washington prairie. Camas (*Camassia quamash*) is a charismatic prairie plant in western Washington with distinctive cultural importance. The group followed up on a field observation of greater camas abundance in rocky surface soils by designing a study examining camas and other flowering plants in relation to surface rocks. The group also excavated, dried, dissected, and weighed sample camas plants so they could determine not only camas abundance in measurement quadrats, but also the relative sizes of bulbs, shoots, and flowers on camas plants. The group presented multiple times on their research, and a second draft of the manuscript applied some suggested changes and was improved as a result. The final draft and presentation were both decent. These data had the potential to link plant traits and physiology to community patterns and microhabitat conditions, which has some interesting basic and applied science implications. Accordingly this work could have some great potential.

Finally, in a third study Maria participated in a study examining *Baslsamorhiza* spp. and their hybrids in an Eastern Washington Steppe habitat. *Balsamorhiza sagittata* is a sunflower-like wildflower in eastern Washington which hybridizes freely with *B. hookeri*, resulting in plants with easily recognizable hybrids with intermediate leaf characteristics. Accordingly, the hybrids allow the opportunity to work with genetic-based patterns using observable phenotypes characteristics in the field. The group first measured multiple landscape-scale transects to determine the relative frequency of parent species of *Balsamorhiza* (*B. sagittata* and *B. hookeri*) and their hybrids. With the frequency of each established, the group then set out to compare plant traits and arthropod communities (mostly pollinators) associated with each cross type (hybrids vs. parents). The group worked well together in the field and returned with a dataset with the potential to address how hybridization interacts with microclimate to influence patterns in dependent and pollinator arthropod communities. In the final analysis the project was a tremendous learning opportunity and raised some interesting opportunities for further study. The final manuscript and presentation were both developing, but both showed significant potential.

In our ecological statistics labs, lectures, and projects, Maria gained a great introduction to topics in parametric, non-parametric, and community analysis approaches in statistics. Moreover, Maria learned about coding and doing these analyses in R. This work required learning about the R coding language and developing comfort managing, importing, and coding for variables in large multivariate datasets.

Overall, Maria should be proud of an interesting multifaceted body of work this quarter.

SUGGESTED COURSE EQUIVALENCIES (in quarter hours) TOTAL: 16

*4 - Ecological Research in Managed Forests
*4 - Field Research in Grazing Systems
*4 - Applied Field Research in Steppe Habitats
4 - Ecological Statistics

* indicates upper-division science credit

Johnson, Tyler Ta — A00423349
Last, First Middle — Student ID

September 2021 - March 2022: Environmental Biology and Chemistry

32 Credits

DESCRIPTION:
Faculty: Andrew D. Brabban, Ph.D. and Paula Schofield, Ph.D.

Environmental Biology and Chemistry was an interdisciplinary science program that used topics and theoretical concepts within microbiology and organic chemistry to study the natural world and human interaction with it, including anthropogenic pollution. It included upper division organic chemistry, environmental and general microbiology, environmental chemistry, and chemical instrumentation. Although each subject is listed separately, the material was delivered in an integrated manner, approaching many concepts from both biological and chemical perspectives. Each week, students spent 9 hours in lecture and small group problem solving sessions, 7 hours in the laboratory and doing some fieldwork, and 2 hours in seminar discussions. Students were evaluated on the basis of weekly homework assignments, seminar assignments, field and laboratory reports, in-person class activities, and performance on weekly on-line quizzes and regular in-person examinations. Some students elected to take components of this full time program.

Organic Chemistry I and II with Laboratory: In fall quarter, students studied the relationship between the structure and behavior of organic molecules. Specific concepts included chemical bonding, acid-base properties of organic molecules, stereochemistry, nomenclature, electron delocalization and resonance. The chemistry of alkanes, alkenes, and alkynes were examined in detail, and the fundamental mechanism of electrophilic addition was emphasized. The laboratory work introduced common techniques in synthetic organic chemistry, including reflux, extraction, recrystallization, steam and simple distillation. Analytical techniques included thin layer chromatography, melting point analysis, gas chromatography, GC-MS, and infrared spectroscopy. In winter quarter, the chemistry of alkyl halides, carboxylic acids and their derivatives, benzene and its derivatives, aldehydes and ketones, as well as free radical reactions were covered. Emphasis was placed on the mechanisms of nucleophilic substitution and elimination, electrophilic aromatic substitution, nucleophilic acyl substitution, and nucleophilic addition. Thermodynamics and kinetics were highly emphasized as fundamental and guiding principles within each topic. For the winter lab work, in addition to a Grignard synthesis and a green chemistry synthesis of adipic acid, students conducted a 5-week interdisciplinary project to characterize microorganisms in soil via phospholipid fatty acid (PLFA) analysis. Students took soil samples from the Evergreen State College Campus, extracted the phospholipids from the membranes of microorganisms, chemically derivatized them to fatty acid methyl esters (FAMEs), then used GC-MS analysis to identify biomarkers and profile microbial communities. The textbook used was *Organic Chemistry* by Paula Yurkanis Bruice (8th Ed.).

Organic Chemistry: Instrumentation and Spectroscopy: Students gained significant hands-on training through individual and group workshops on the following instruments: FT-IR spectrophotometer, Gas Chromatograph, Gas Chromatograph-Mass Spectrometer, and FT-NMR spectrometer. In addition to learning significant background theory, students learned sample preparation, operation, and analysis of spectra/data for each instrument, and used this knowledge to analyze products from synthetic labs. Students also applied these skills to elucidate the structures of a series of unknown compounds through workshops and homework assignments. In addition, students used a tailored GC-MS method for the separation and analysis of fatty acid methyl ester (FAME) biomarkers to study microbial communities in soil.

General and Environmental Microbiology with Laboratory: This component of the program began by examining the broad variety of microorganisms so far identified, ways of growing microorganisms and measuring growth, the biochemistry of these species and their varying cellular structure. It then progressed to examining the roles microorganisms play in the environment and the broad diversity of

ecosystems they occupy. Specifically, we examined microbial metabolism and biogeochemical cycling at a biochemical level, examining the many modes of aerobic and anaerobic catabolism, such as chemolithotrophy. The laboratory component was structured to teach the basic techniques of microbiology required to safely and precisely manipulate microorganisms, such as aseptic technique, making media and growing cultures. Students learned to work quantitatively with organisms carrying out MPN and dilution series to examine water samples, bacterial and phage replication. Students also used quantitative methods to examine cellular processes such as electron transport, using biochemical assays such as the Hill Reaction. The textbook used was Madigan, M., Martinko, J., Bender, K.S., Buckley, G.H., Sattley, W.M., and Stahl, D.A. *Brock's Biology of Microorganisms* 15/e. New Jersey: Pearson: Benjamin Cummings, 2017.

Microbial Ecology and Bioremediation with Laboratory and Field Methods: Students gained an understanding of the relationships between, and the role of, microorganisms in natural and polluted environments. Course material examined microbial metabolism and biogeochemical cycling, water pollution, toxicology, wastewater treatment, methods of measuring microbial numbers and microbial activity, abiotic and biotic interactions within microbial communities, and bioremediation. Remediation of both organic and inorganic chemicals using active/passive, *in situ/ex situ*, chemical/biological processes including the design and use of wetlands was covered. Lab and field work focused on developing both quantitative and qualitative methods of measuring microbial growth and pollution including DO and BOD_5 assays, MPN, viable and total cell count methods, culture enrichment, soil analysis and genetic methods such as PCR detection of microorganisms in water samples. The textbook used was Madigan, M., Martinko, J., Bender, K.S., Buckley, G.H., Sattley, W.M., and Stahl, D.A. *Brock's Biology of Microorganisms* 15/e. New Jersey: Pearson: Benjamin Cummings, 2017.

Environmental Chemistry: Each week students read primary literature and other texts, and completed detailed homework assignments on each reading. Topics covered included green chemistry, energy use in the USA, biofuels from algae, contaminants of emerging concern, environmental hydrocarbon degradation, and the anthropogenic carbon cycle. Readings were mostly taken from primary literature: *Journal of the American Chemical Society, Bioresource Technology, Chemosphere, Environmental Pollution*; and also other texts: *US Energy Information Administration (EIA) Annual Outlook 2021; epa.gov*.

EVALUATION:
Written by: Andrew D. Brabban, Ph.D. and Paula Schofield, Ph.D.

Tyler (Maria) entered this program to learn advanced concepts, as well as lab and field techniques within biology and chemistry to prepare for a future career in science.

Coursework:
In the organic chemistry component of the program, Maria submitted all assigned work and completed all online and in-person quizzes and exams. Maria's work and in-class contributions demonstrated an excellent grasp of the fundamentals of organic chemistry, specifically, nomenclature, structure-property relationships, stereochemistry, and thermodynamic principles governing molecular structure and reactions. In addition, Maria showed a very good to excellent understanding of organic reactions, mechanisms, and multi-step synthetic sequences. As a result, Maria was successful in applying this knowledge to solve applied synthetic and mechanistic problems.

Overall, Maria demonstrated a good grasp of both general and environmental microbiology, being able to solve all of the qualitative and quantitative problems, including growth, cell quantification, cell morphology and structure, and metabolism. In the environmental component, Maria solved all the quantitative redox and thermodynamic problems as they relate to the environment. In microbial ecology and bioremediation, Maria showed a very good and at times excellent understanding of the theory covered and the ability to

apply both quantitative and qualitative methods to measure microbial numbers and activity in the environment. Maria was also able to apply their biogeochemical knowledge to assess polluted sites, and then design the appropriate remediation processes. Maria completed most of the required online quizzes and homework through both quarters and they were always good.

Maria came to seminar discussions well prepared, completing detailed assignments on the readings, demonstrating Maria's strong understanding of the topics and thorough reading of the texts. In addition, Maria was an engaged member of seminar discussions, contributing rigorously to the dialogue.

Laboratory and Field Work:
Maria successfully worked with a variety of lab partners, and overall learned the basic laboratory bench skills and techniques in organic chemistry and microbiology.

Maria worked very well with their group members on all aspects of the interdisciplinary field assessment and lab projects. These included an in-depth study (discharge, dissolved oxygen, conductivity, pH, temperature) of McLane Creek, a rural salmon spawning creek that drains into Eld Inlet of Puget Sound; a BOD5 study of the college campus natural waters; and the examination of ground water flow in reference to petrochemical pollution. Maria's data collection was efficient and thorough, and overall, their group's project reports were organized, included site descriptions, the appropriate calculations, tables, and figures. Overall, the two larger group reports on McLane Creek and BOD5 were both excellent and very good respectively. Maria also contributed significantly to the 5-week group project on the characterization of soil microbial communities via phospholipid fatty acid/FAME analysis. Maria's group obtained and characterized some FAMEs as microbial biomarkers. Following feedback on a draft report, Maria's group submitted a good final extensive lab report of this work. It lacked some detail in sections, but was organized and contained very good site analyses and data presentation.

Chemical Instrumentation and Spectroscopy:
Maria learned the theory and practical application of chemical instrumentation typically used in organic chemistry. Specifically, Maria learned how to prepare samples, operate, and analyze data from the FT-IR, GC, and GC-MS instruments, and used these to analyze products from organic syntheses. In addition, Maria and their project group successfully used a tailored GC-MS method for the separation and analysis of FAME biomarkers to study microbial communities in soil.

Maria learned the theory of FT-NMR and successfully analyzed spectra, as evidenced by homework and quiz scores. Maria also took two hands-on FT-NMR instrumentation training workshops.

SUGGESTED COURSE EQUIVALENCIES (in quarter hours) TOTAL: 32

*11 - Organic Chemistry I and II with Laboratory
*4 - Organic Chemistry: Instrumentation and Spectroscopy
*5 - Microbial Ecology with Laboratory
*4 - General Microbiology with Laboratory
*3 - Environmental Microbiology with Laboratory
*3 - Biogeochemistry and Bioremediation with Field Methods
*2 - Environmental Chemistry

* indicates upper-division science credit

Johnson, Tyler Ta — A00423349
Last, First Middle — Student ID

September 2019 - June 2020: Integrated Natural Science

38 Credits

DESCRIPTION:
Faculty: Abir Biswas, Ph.D., Nancy Murray, Ph.D., and Paula Schofield, Ph.D.

Integrated Natural Science is a full year interdisciplinary science program that includes general biology, general chemistry, historical geology, soil science, and science communication. Although each subject is listed separately, the material was delivered in an integrated manner, approaching many concepts from biological, historical, and chemical perspectives. Students were assessed on completion of homework assignments, quality of laboratory notebooks and reports, and performance on weekly quizzes and several examinations. Some students enrolled in the program full time, taking all components listed below, for a total of 48 credits. Other students enrolled in the program part-time, taking just selected components, for a credit total ranging from 11-44 credits. Due to the Covid-19 pandemic, spring quarter classes were delivered remotely.

General Biology I, II and III with Laboratory: Using the text *Biological Science*, 6th ed., by Freeman, et al. students studied the basic tenets of evolution, mitosis and meiosis, Mendelian genetics, DNA replication, transcriptional regulation (prokaryotic and eukaryotic), translation, and biological molecules, cellular respiration, photosynthesis, cell cycle regulation, metabolism, neurophysiology, plant form and function, plant sensory systems, and ecology. In the lab, students acquired bench skills in data collection and analysis, aseptic technique, bacterial growth and antibiotics, polymerase chain reaction (PCR) and restriction digest, enzyme regulation, differential centrifugation and protein isolation and column chromatography.

General Chemistry I, II and III with Laboratory: the textbook used was *Chemistry: The Central Science*, 14th Ed., by Brown, Le May and Bursten. Topics covered include stoichiometry, aqueous reactions, ionic equations, periodic properties, electron configuration, Lewis structures, chemical bonding, molecular shape, intermolecular forces, liquids and solutions. More detailed topics covered include thermochemistry, chemical kinetics, and chemical equilibria. Aspects of chemistry as they relate to biological systems were emphasized, such as biological redox reactions, enzyme kinetics, and the thermodynamics of biochemical reactions. In spring quarter, students applied their knowledge to more complex concepts in bonding (hybrid orbital and molecular orbital models), aqueous equilibria: acid-base, buffers, and solubility product, electrochemistry and gas laws. In the laboratory, students were introduced to the basic techniques of lab and field science. These included UV and visible spectroscopy, standard curve methods, aqueous titrations, gas chromatography and thin-layer chromatography, kinetics of an enzymatic reaction. Field measurements included dissolved oxygen, pH, temperature, flow rate, and conductivity.

Historical Geology: the textbook *Earth System History*, 4th Ed., by Stanley and Luczaj was used to cover topics related to the evolution of life and the evolution of geochemical cycles through geologic time. Students started with the Big Bang and Hadean Eon and progressed through time into the Pleistocene Epoch, with coursework supplemented by one fossil-based laboratory activity as well as abstracts and figures from primary literature.

Fundamentals of Soil Science: the textbook *Elements of the Nature and Properties of Soils*, 3rd ed., by Brady and Weil was used to cover topics related to soil development and classification, the soil food web, and carbon, nitrogen, and phosphorus cycling in soils. Readings were supplemented with abstracts and figures from primary literature. Students characterized and collected soils from a local forest, and laboratory activities were focused on quantifying % water, % organic matter, and grain size distribution of these soils.

Johnson, Tyler Ta — A00423349
Last, First Middle — Student ID

Science Communication: In this portion of the program, students worked to develop critical skills in science communication and research translation, learning to distill complex scientific concepts into understandable language for a lay audience. One project had students examining a primary literature paper and a corresponding NPR article for a general audience. Students worked in groups to examine what parts of the paper were included and excluded from the NPR article and to provide a rationale for those decisions. For the second assignment, students were asked to read a series of articles on microplastics, and were tasked with giving a summary talk in PowerPoint for a non-science audience, based on those readings. The third assignment required students to research the pros and cons of a local issue regarding an endangered species, the Mazama pocket gopher. A final assignment required students to research an invasive species and create a PowerPoint presentation. For this project, students were required to present their findings to their peers, giving them more experience presenting information in front of an audience.

EVALUATION:
Written by: Abir Biswas, Ph.D., Nancy Murray, Ph.D., and Paula Schofield, Ph.D.

Tyler (Maria) entered this program to gain an understanding of the fundamentals of science and its application in preparation for advanced work in the sciences. Throughout the year, Maria developed a solid foundation in most areas, learning important topics in biology, chemistry, geology and soil science. Maria also developed quantitative, laboratory, field, and communication skills that are all essential to becoming a literate scientist.

In the biology part of the program, Maria has made very good progress. Maria's performance on the weekly quizzes demonstrated a strong ability to address scientific questions in a logical manner and to synthesize information. Maria regularly attended and participated in lectures, workshops, and laboratory sessions and handed in assignments on time. Maria is also a capable lab bench scientist, and is able to follow complex protocols. Maria's lab notebook improved with feedback and is now detailed, complete and easy to follow.

In the yearlong study of general chemistry, Maria worked to gain a foundation in chemistry and apply this knowledge to other sciences. Maria attended class activities and completed homework assignments. Overall, Maria demonstrated a very good understanding of the fundamentals of general chemistry, such as chemical equations, Lewis structures, chemical bonding, and stoichiometry. In addition, Maria showed a good grasp of some more complex and quantitative topics. Maria worked well both individually and in small groups to apply knowledge to solve problems. In lab, Maria carried out experiments in a safe and professional manner and learned the basic laboratory bench skills and techniques in general chemistry. Maria's chemistry lab notebook needs some work; it was somewhat disorganized, and lacked key details of the lab activities. It did show good preparation for laboratory activities.

In the historical geology component of the program, Maria was well-engaged and demonstrated an excellent understanding of the program content through in-class examinations. Maria had excellent attendance of the lectures and workshops, and often completed homework assignments of variable quality. Through in-class examinations, Maria demonstrated an excellent to outstanding understanding of the evolution of life and geochemical systems in the Hadean through late Paleozoic, and again demonstrated an excellent to outstanding understanding of topics related to events through the Mesozoic Era. Maria worked hard over the quarter, and on a final examination demonstrated an excellent understanding of events and climate through the Pleistocene Epoch.

In the soil science component of the program, Maria was well-engaged and demonstrated an excellent understanding of the program content through in-class examinations. Maria had excellent attendance of the lectures and workshops, and completed 3 of 9 homework assignments on time that were very well done. Through in-class examinations, Maria demonstrated an excellent understanding of topics related to

Johnson, Tyler Ta — A00423349
Last, First Middle — Student ID

soil formation and development and Maria then demonstrated an excellent understanding of topics related to soil classification, texture, and pH (including quantitative questions regarding changes in pH). Maria worked hard over the quarter and demonstrated an excellent to outstanding understanding of material on a final in-class examination including carbon, nitrogen, and phosphorus cycles in soil.

SUGGESTED COURSE EQUIVALENCIES (in quarter hours) TOTAL: 38

15 - General Biology I, II and III with Laboratory
15 - General Chemistry I, II and III with Laboratory
4 - Historical Geology
4 - Fundamentals of Soil Science

EVERGREEN

The Evergreen State College • Olympia, WA 98505 • www.evergreen.edu

EVERGREEN TRANSCRIPT GUIDE

Accreditation: The Evergreen State College is fully accredited by the Northwest Commission on Colleges and Universities.

Degrees Awarded: The Evergreen State College awards the following degrees: Bachelor of Arts, Bachelor of Science, Master of Environmental Studies, Master of Public Administration and Master In Teaching. Degree awards are listed on the Record of Academic Achievement.

Educational Philosophy:

Our curriculum places high value on these modes of learning and teaching objectives:

- Interdisciplinary Learning
- Collaborative Learning
- Learning Across Significant Differences
- Personal Engagement
- Linking Theory with Practical Applications

Our expectations of Evergreen Graduates are that during their time at Evergreen they will:

- Articulate and assume responsibility for their own work
- Participate collaboratively and responsibly in our diverse society
- Communicate creatively and effectively
- Demonstrate integrative, independent, critical thinking
- Apply qualitative, quantitative and creative modes of inquiry appropriately to practical and theoretical problems across disciplines, and,
- As a culmination of their education, demonstrate depth, breadth and synthesis of learning and the ability to reflect on the personal and social significance of that learning.

Our students have the opportunity to participate in frequent, mutual evaluation of academic programs, faculty and students. In collaboration with faculty and advisors, students develop individual academic concentrations.

Academic Program

Modes of Learning: Evergreen's curriculum is primarily team-taught and interdisciplinary. Students may choose from among several modes of study:

- **Programs:** Faculty members from different disciplines work together with students on a unifying question or theme. Programs may be up to three quarters long.
- **Individual Learning Contract:** Working closely with a faculty member, a student may design a one-quarter-long, full-time or part-time research or creative project. The contract document outlines both the activities of the contract and the criteria for evaluation. Most students are at upper division standing.
- **Internship Learning Contract:** Internships provide opportunities for students to link theory and practice in areas related to their interests. These full- or part-time opportunities involve close supervision by a field supervisor and a faculty sponsor.
- **Courses:** Courses are 2-6 credit offerings centered on a specific theme or discipline.

The numerical and alpha characters listed as Course Reference Numbers designate modes of learning and are in a random order.

Evaluation and Credit Award:

Our transcript consists of narrative evaluations. Narrative evaluations tell a rich and detailed story of the multiple facets involved in a student's academic work. A close reading of the narratives and attention to the course equivalencies will provide extensive information about student's abilities and experiences. Students are not awarded credit for work considered not passing. Evergreen will not translate our narrative transcript into letter or numeric grades.

Transcript Structure and Contents: The Record of Academic Achievement summarizes credit awarded, expressed in quarter credit hours. Transcript materials are presented in inverse chronological order so that the most recent evaluation(s) appears first.

Credit is recorded by:

Quarter Credit Hours:	Fall 1979 to present
Evergreen Units:	1 Evergreen Unit (1971 through Summer 1973) equals 5 quarter credit hours
	1 Evergreen Unit (Fall 1973 through Summer 1979) equals 4 quarter credit hours

Each academic entry in the transcript is accompanied by (unless noted otherwise):

- The Program Description, Individual Contract or Internship Contract which explains learning objectives, activities and content of the program, course or contract.
- The Faculty Evaluation of Student Achievement provides information on specific work the student completed and about how well the student performed in the program or contract.
- The Student's Own Evaluation of Personal Achievement is a reflective document written by the student evaluating his or her learning experiences. Students are encouraged but not required to include these documents in their official transcript, unless specified by faculty.
- The Student's Summative Self Evaluation is an optional evaluation summarizing a student's education and may be included as a separate document or as a part of the student's final self- evaluation.

Transfer credit for Evergreen programs, courses and individual study should be awarded based upon a careful review of the transcript document including the course equivalencies which are designed to make it easier for others to clearly interpret our interdisciplinary curriculum. These course equivalencies can be found at the conclusion of each of the Faculty Evaluation of Student Achievement.

The college academic calendar consists of four-eleven week quarters. Refer to the college website (www.evergreen.edu) for specific dates.

This record is authentic and official when the Record of Academic Achievement page is marked and dated with the school seal.
All information contained herein is confidential and its release is governed by the Family Educational Rights and Privacy Act of 1974 as amended.
If, after a thorough review of this transcript, you still have questions, please contact Registration and Records: (360) 867-6180.