

Jared Keith Averitt

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BIOGRAPHY

With a diverse background in biology, physics, mathematics, chemistry, and computer science, I'm a final-year NSF Graduate Research Fellow specializing in Nanoscience and Materials Science. My research bridges theory and experiment through advanced computational methodologies. I've authored/co-authored multiple publications and bring expertise in Density Functional Theory, computational physics, neural-network-based modeling, and more.

EDUCATION

University of North Carolina Greensboro

Greensboro, NC

- Ph.D., Nanoscience and Material Science (4 years) 2020 — present
- National Science Foundation Graduate Research Fellow (2021318933)
- Dissertation: *Development of New Computational Methodologies for the Study of Dynamics in 2D Nanoscale Devices* Anticipated Completion May 2024
 - Committee Chairs: Dr. Tetyana Ignatova and Dr. Joeseeph Starobin
- Additional Graduate Physics Coursework at Duke University

Austin Peay State University

Clarksville, TN

- B.S., Physics Major - Mathematics Minor 2018 — 2020
- B.S., Biology Major - Chemistry Minor 2010 — 2020

PROFICIENT RESEARCH SKILLS

Computational

- Density Functional Theory (VASP, Gaussian16)
- Machine Learning (TorchANI, PyTorch, Scikit-learn)
- High Performance Computing and programming for massively parallel computers (Distributed Computing, openMPI, CUDA, GPU)
- Finite Element Modeling (COMSOL Multiphysics)
- Programming Languages (Fortran, C++, Python, MATLAB, Mathematica)
- Atomic and Molecular Tools (VMD, Chemcraft, ASE, Multiwfn)
- LaTeX
- Molecular Dynamics (ReaxFF, SDF)
- Mac OS, Linux and Windows subsystems
- Autodesk Software (Inventor, Fusion 360)

Biochemical Analysis

- PCR (Quantitative, Real-time)
- ELISA
- Horizontal gene transformations

Materials Characterization

- Positron Annihilation Lifetime Spectroscopy (ORTEC)
- Confocal Raman Spectroscopy (HORIBA XploRA)
- SEM (Hitachi S-3400, Oxford Aztec INCA X-Act)

Chemical Analysis

- NMR (Bruker Fourier 300)
- UV-Vis (HP 8453)
- FTIR (Bruker Tensor 27)

Fabrication

- 3D-Printing (Maker-bot)

Microscopy

- Confocal (bright field, phase contrast)
- Wide Field Fluorescence
- Differential interference contrast (DIC)

GRADUATE RESEARCH EXPERIENCE

The Pennsylvania State University

Visiting Research Scholar with Dr. Vincent Crespi, Dr. Adri van Duin, Dr. Weiss Reinhart

State College, PA
2023 – present

- Conducting computational research at the NSF-funded Two-Dimensional Crystal Consortium – Materials Innovation Platform Theory Group, developing a neural network and algorithm for designing MoS₂ - Pyrene optical sensors. I performed forcefield training for ReaxFF, studying polymer adhesion on defective graphene surfaces under its creator's guidance. Findings were presented through three posters, and a manuscript is currently in preparation.

US Department of Defense Army DEVCOM Soldier Center

Graduate Student Scholar in Partnership with The Joint School Of Nanoscience and Nanoengineering (#W911QY2220006)

Natick, MA
2022 - present

- Engaging with soldiers and veterans, I grasp their specific safety needs, simulate reusable nanoscale optical sensors for extreme chemical hazard detection, and develop a neural network method to screen for ammonia and phosphate compounds. I've shared these findings through three posters.

Nano-Opto-Bio Lab, University of North Carolina at Greensboro

NSF Graduate Research Fellow (no. 1945980, ID: 2021318933)

Greensboro, NC
2020 - present

- I've developed computational techniques for nano-scale analysis, integrating Neural Networks and Molecular Dynamics. I've optimized solid-state optical sensor design and calculated polymer adhesion energies for graphene transfer methods. Additionally, I've explored water's electrostatic potential shielding effects in diverse environments using Finite Element Method (FEM). Authored/co-authored papers and presented findings through six posters, with one paper submitted and another in preparation.

UNDERGRADUATE RESEARCH EXPERIENCE

Materials Fabrication and Characterization Lab, Austin Peay State University

Undergraduate Research Assistant with Dr. Roman Holovchak and Dr. Andriy Kovalskiy

Clarksville, TN
2018 - 2020

- I utilized Positron Annihilation Lifetime Spectroscopy (PALS) to characterize water inclusions in natural quartz. Engineered an optimized device for precise deposition of a radioactive positron source onto thin films and developed a 3D-printed apparatus to position the source between samples for measurements. Analyzed PALS data, presented three poster presentations.

Microorganism based Biofuel Production Lab, Austin Peay State University

Undergraduate Research Assistant with Dr. Sergei Markov

Clarksville, TN
2009 - 2012

- supervised and trained three researchers, optimized bioreactor parameters for biofuel production, conducted chemical analysis for data acquisition, co-authored a peer-reviewed paper, and presented four posters along with an oral presentation.

and
2015 - 2018

HONORS, AWARDS, FELLOWSHIPS, GRANTS AND SCHOLARSHIPS

• NSF Graduate Research Fellowship Program (no. 1945980, ID: 2021318933)	\$155,000	2021 – Present
• NSF XSEDE Start-up Allocations (PHY220034) : Modeling of molecules adsorbed on the surface of 2D materials: multi-component analysis	\$516	2022 – 2023
• Study of fundamental properties of two-dimensional platform for biosensor application (001775) : UNCG Graduate Student Association Research Capstone Fund	\$300	October 2020
• Humidity Sensor / Controller for Atmospheric Atomic Force Microscopy (003196) : UNCG Graduate Student Association Research Capstone Fund	299.35	February 2022
• Educational Peltier Cooler for Teaching and Research Advancements (004645) : UNCG Graduate Student Association Research Capstone Fund	294.35	November 2023
• NASA Scholarship : Tennessee Space Grant Consortium (no. NNX15AR73H)	\$6,000	2018 – 2019
• Summer Undergraduate Research Fellowship : APSU	\$5,000	2018 – 2019
• Presidential Research Scholarship : APSU	\$2,000	2016 – 2017

PUBLICATIONS

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- [1] **Jared Averitt**, Sajedah Pourianejad, Olubunmi O Ayodelle, Anthony Trofe, Kirby Schmidt, Joeseph Starobin, Tetyana Ignatova, "Optimized nanodevice fabrication using clean transfer of graphene by polymer mixture: Experiments and Neural Network based simulations". arXiv. 2023 October. <https://arxiv.org/abs/2310.10020> DOI: 10.48550/ARXIV.2310.10020 (in review ACS Applied Nano Materials)
- [2] **Jared Averitt**, Anthony Trofe, Sajedah Pourianejad, Tetyana Ignatova, "Shielding effect of water in Kelvin Probe Force Microscopy: experimental and finite element analysis approach", 2024, In preparation (expected submission to IEEE January 2024)
- [3] **Jared Averitt**, Wesley Reinhart, Vincent Crespi, Joeseph Starobin, Tetyana Ignatova, "Neural Network method for the discovery of nanoscale optical-based sensors of ammonia and phosphate compounds", 2024, In preparation (expected submission in January 2024)
- [4] Olubunmi O Ayodelle , Adeyinka O Adesina, Sajedah Pourianejad, **Jared Averitt** , Tetyana Ignatova, "Recent Advances in Nanomaterial-Based Aptasensors in Medical Diagnosis and Therapy" Nanomaterials (Basel), April, 2021 6;11(4):932. <https://www.mdpi.com/2079-4991/11/4/932> DOI: 10.3390/nano11040932
- [5] S. Markov, **J. Averitt**, B. Waldron. "Bioreactor for glycerol conversion into H₂ by bacterium Enterobacter aerogenes" International Journal of Hydrogen Energy, January 2001 Vol 36, 2011. P 262-266. <https://linkinghub.elsevier.com/retrieve/pii/S0360319910020008> DOI: 10.1016/j.ijhydene.2010.09.090

MENTORING AND TEACHING EXPERIENCE

Governor's School for Computational Physics

Teaching Assistant and Resident Mentor with Dr. Alex King and Dr. Daniel Mayo

Clarksville, TN
2019 - 2020

- Managed grading, guided experiments, and provided one-on-one support and mentoring for students for 41 high school students in a Computational Physics Method course for seven college credits in an intensive three-week pre-college STEM program for 41 high school students

Tri-County (TRIO) Upward Bound, Austin Peay State University

Instructor for Mathematics and Physics with Upward Bound director, Melissa Conwell

Clarksville, TN
2019 - 2020

- Designed and delivered engaging lesson plans to foster meaningful learning experiences in the Department of Education funded 5-week pre-college preparatory program for economically disadvantaged high school students, and maintained academic records.
- Coordinated with APSU Physics Department's lab manager, who granted us access to the same resources as the Gov School students. TRIO now benefits from these resources for future cohorts.

Physics Department, Austin Peay State University

Teaching Assistant for undergraduates

Clarksville, TN
2018 - 2020

- Led bi-weekly recitations and collaborating with faculty enhancing student-professor connections, enabling discussions to pinpoint learning gaps and exposing me to diverse teaching methods, while bridging gaps between students and professors honed my understanding of students' learning needs, guiding them toward comprehending course material and succeeding in their studies.
- Supported courses (Instructors):
 - Calculus-based Physics (Dr. Roman Holovchak and Dr. William Longhurst)
 - Algebra-based Physics (Dr. Xiong Pei, Dr. Andriy Kovalskiy and Dr. Arthur Carpenter)

Mathematics Department, Austin Peay State University

Teaching Assistant for undergraduates

Clarksville, TN
2018 - 2020

- Empowered students with deficiencies in mathematics to rethink their study habits and to improve their mathematics skills. Developed specific lesson plans for the students to reinforce the concepts they were learning in class while also improving their skills in algebra.
- Supported courses (Instructors):
 - Single-variable Calculus (Dr. Daniel Mayo)
 - Elementary Statistics (Dr. Ben Ntatin, Dr. Matthew Jones)

Academic Support Department, Austin Peay State University

CRLA Peer Tutor Level 1 for undergraduates

Clarksville, TN
2018 - 2020

- Collaborated with director, providing both group and one-on-one tutoring for students with educational deficiencies.
- Supported courses:
 - College Algebra, Elementary Statistics, Calculus, Organic Chemistry, Algebra-based Physics, Calculus-based Physics, Anatomy and Physiology

SYNERGISTIC ACTIVITIES

- **Instructor, AI Methods in Advanced Materials Research** : Leading a ten-hour course beginning January 2024 at the Joint School of Nanoscience and Nanoengineering in Greensboro, NC, equipping graduate students with essential Machine Learning and Neural Network skills tailored for addressing intricate challenges in materials research, encompassing convolutional neural networks, Bayesian analysis, and various techniques for robust data analysis.
- **Physicist To-Go Volunteer with the American Physical Society**: Engaging in a remote capacity since 2020, virtually connecting with twelve demographically diverse classrooms spanning multiple states such as PA, CO, TX, TN, NC, and MA. Facilitating interactive sessions by fielding inquiries from K-12 students about the role of physicists while fostering enthusiasm for physics, aiming to inspire the next generation to delve into scientific exploration.
- **K-5 North Central Region 5 Science and Engineering Fair Mathematics and Physics Judge** : Since 2021, I offer constructive feedback on student projects and provide guidance to budding scientists and engineers, aiming to recognize and validate their efforts in pursuing scientific knowledge.
- **Ad hoc Reviewer for the Southeastern Section of the American Physical Society** : I am involved in evaluating candidates and participating in the selection process for the prestigious annual Jesse W. Beams Award.
- **K-12 Outreach Events Volunteer** : Contributing at The Joint School of Nanoscience and Nanoengineering in Greensboro, NC since 2021, I engage in hands-on demonstrations focusing on Nanoscience, aiming to infuse excitement into STEM education. Additionally, I serve as a Graduate Researcher Panelist, offering insights to undergraduates keen on pursuing graduate studies in materials science.
- **Mentor, Draelos Scholar Program** : I led a ten-week research project, instructing two students in machine learning, High Performance Computing, and Density Functional Theory. I guided their practical application of these methods in exploring optical and electronic properties of nanoscale devices constructed from pyrene and a graphene flake, culminating in the students delivering concise 5-minute oral presentations at the program's conclusion.
- **Graduate Student Peer Mentor, The Joint School of Nanoscience and Nanoengineering** : Since 2021, I've mentored seven graduate students, all of whom continue on a STEM track, combined have four publications. Including graduate students from Ghana, Bangladesh, and Jordan. holding weekly sessions with three junior lab members on diverse topics like writing grants, mastering research techniques, publishing, communication, professional development, stress management, and well-being.
- **Education Outreach Volunteer in Nalerigu, Ghana**: during June to July 2010, I collaborated with the Baptist Medical Center and a remote community impacted by tuberculosis. By fostering cultural harmony and building strong connections, I significantly contributed to the success of education initiatives and the effective distribution of vaccinations.

MEMBERSHIP OF PROFESSIONAL SOCIETIES

Materials Research Society JSNN Student Chapter	2021 – present
American Physical Society	2018 – present
Sigma Phi Sigma Physics Honor Society	2018 – present
Del Square Psi	2018 – 2020
Tri-Beta Biological Honor Society	2010 – 2020

TRAINING AND CERTIFICATES

Argonne National Laboratory

Certificate: Introduction to AI-Driven Science on Supercomputers

(remote) Lemont, IL
September — Nov 2022

- Gained hands-on expertise in applying AI to intricate scientific problems, engaged with Argonne scientists to understand their AI-driven research, and underwent eight weeks of intensive training, culminating in advanced proficiency in using AI on supercomputers. This knowledge was applied to research resulting in a pending paper submission.

COMSOL Multiphysics

Certificate: Intensive Introduction to Using COMSOL for Modeling and Simulation Course

(remote) Burlington, MA
July 2021

- Mastered essential setup tasks like geometry creation, interactive meshing, and postprocessing, while also delving into advanced topics—applying theoretical knowledge of the finite element method to multiphysics modeling. Completed COMSOL Multiphysics Introductory training, leveraging this expertise in research, resulting in a forthcoming paper.

CONFERENCE PRESENTATIONS

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- [1] **J.K. Averitt**, Joeseeph Starobin, Tetyana Ignatova. "Deconvolution the Electric-Shielding Effect of Ubiquitous Water in Kelvin Probe Force Microscopy: Finite Element Approach". American Physical Society, March Meeting. In Person, March 3-8, 2024. Abstract Submitted
- [2] Besan Khader, Pearson Hart, Arif Khan, **Jared Averitt**, Aleksandrs Prokofjevs, Tetyana Ignatova. "Development of Nanoscale Optical Sensor for Ammonia Detection". American Physical Society, March Meeting. In Person, March 3-8, 2024. Abstract Submitted
- [3] **J.K. Averitt**, Joeseeph Starobin, Tetyana Ignatova. "Computational Materials Design of Optical Based Nanoscale Sensing Devices". NSF Nanoscale Science and Engineering Grantees Conference. Alexandria, VA. December 7-8, 2023. Poster Submitted
- [4] **J.K. Averitt**, Joeseeph Starobin, Tetyana Ignatova. "High throughput Potential Neural Network Method to exploit non-local interactions on graphene interface". 2DLM/2DCC Graphene and Beyond Workshop. University Park, PA. May 17-18, 2023. Poster
- [5] **J.K. Averitt**, Sajedeh Pourianejad, Olubunmi Ayodelle, Tetyana Ignatova. "Electronic structure simulations of polymer(s) on graphene through a potential neural network". American Physical Society, March Meeting. Virtual, March 20-22, 2023. Poster
- [6] **Jared Averitt**, Anthony Trofe, Joseph Starobin, Tetyana Ignatova, Micheal Ghebrehbrham. "Development of Maximal Scattering Camouflage Clothing for Soldiers Using 2D Materials", Grand opening of ICONS ,Greensboro NC. November 21, 2022. Poster
- [7] **Jared K. Averitt**, Besan Khader, Joseph Starobin, Tetyana Ignatova, Micheal Ghebrehbrham. "Screening Library of in-silico Pyrene-graphene Based Sensors", Grand opening of ICONS, Greensboro NC. November 21, 2022. Poster
- [8] S. Kalkar, A. Adesina, **J. Averitt**, D. Herr, T. Ignatova. "Tailoring Properties of Cyanobacteria with SWCNT Hybrid". NanoImpacts 2022: SemiSynBio and Beyond, Greensboro NC. October 13 -15, 2022. Poster

- [9] **J.K. Averitt**, Sajedeh Pourianejad, Olubunmi Ayodelle, Tetyana Ignatova. "Energy decomposition analysis from DFT investigations of polymer(s) on graphene". 2DLM/2DCC Graphene and Beyond Workshop. University Park, PA. May 18-19, 2022. Poster
- [10] **J.K. Averitt**, Sajedeh Pourianejad, Olubunmi Ayodelle, Tetyana Ignatova. "DFT simulation of polymer(s) on graphene: Polymer confirmation and adhesion energy considerations". American Physical Society, March Meeting. Chicago, IL. March 14-18, 2022. Poster
- [11] Sajedeh Pourianejad, **J. Averitt**, O. Ayanbajo, S. Aravamudhan, T. Ignatova, "Work function modulation in 2D MoS₂". Carolina Science Symposium. Virtual, November 12-13, 2020. Poster
- [12] **J. Averitt**, M. Mouton, K. Webster, J. Shajahan, A. Maselugbo, S. Loeffler. "Summary of the UN GCO-II", Virtual networking session entitled: "Convergence Research for the Biorefinery: A Networking Session". June 22, 2020. Oral
- [13] **J.K. Averitt**, R. Golovchak. "Positron Annihilation Lifetime Spectroscopy of Natural Quartz (SiO₂)". NASA Southeast Regional Space Grant Meeting. Nashville, TN. September 26-27, 2019. Poster
- [14] **J.K. Averitt**, R. Golovchak. "Re-usable β^+ source - sample sandwich for positron annihilation lifetime spectroscopy". Annual Meeting of the Tennessee Section of the American Association of Physics Teachers. (TAAPT 2019). Knoxville, TN. March 29-30, 2019. Poster
- [15] **J.K. Averitt**, R. Golovchak. "Re-usable Positron Source for Non-Destructive Positron Annihilation Lifetime Spectroscopy of Solids". Tennessee Posters at the Capitol. Nashville, TN. February 26, 2019. Poster
- [16] **J. Averitt**, S. Markov. "Hydrogen Production from Malate or Glycerol by Purple Non-Sulfur Photosynthetic Bacteria". Bioenergy Sustainability Conference. Nashville, TN, October 21-23, 2019. Poster
- [17] **J.K. Averitt**, R. Golovchak. "Design and Preparation of Positron Source for Non-Destructive Positron Annihilation Lifetime Spectroscopy". 85th Annual Meeting of the APS Southeastern Section (SESAPS-2018). Knoxville, TN, Nov. 8-10, 2018. *Bulletin of the American Physical Society*. Abstract: D05.00042. Poster
- [18] **J. Averitt**, S. Childs, S. Markov. "Biomass and oil production by microalga *Neochloris oleoabundans* in floating, rocking and stationary bag photobioreactors". National Conference on Undergraduate Research (NCUR-2018). Oklahoma City, OK. April 4-7, 2018. Poster
- [19] **J.K. Averitt**, S. Markov. "Novel floating-type photobioreactor for microalga growth and biofuel production". 125th Annual Meeting of Tennessee Academy of Science (TAS-2015), Murfreesboro, TN. November 20, 2015. Oral
- [20] **J. Averitt**, S. Markov. "Bioreactor for glycerol conversion into H₂ and ethanol by bacterium *Enterobacter aerogenes*". 111th Annual General Meeting of American Society for Microbiology (ASM-2011). New Orleans, LA. May 21-24, 2011. Poster

REFERENCES

Dissertation Advisors:

Tetyana Ignatova

Associate Professor, Nanoscience

University of North Carolina Greensboro

(336) 285-2791, t_ignato@uncg.edu

Joseph Starobin

Professor, Nanoscience
University of North Carolina Greensboro
(336) 285-2871, jmstarob@uncg.edu

Professional Contacts:**Vincent H. Crespi**

Distinguished Professor of Chemistry, Physics, and Mat. Sci. & Eng.
Director, Penn State Materials Research Science and Engineering Center
Theory Lead, Two-Dimensional Crystal Consortium, an NSF Materials Innovation Platform
Pennsylvania State University
(814) 863-0163, vhc2@psu.edu

Undergraduate Academic Advisors:**Alex King**

Professor and Chair, Department of Physics, Engineering and Astronomy
Director, Tennessee Governor's School for Computational Physics
Austin Peay State University
(931) 221-6102, kinga@apsu.edu

Pei Xiong-Skiba

Professor, Department of Physics, Engineering and Astronomy
Austin Peay State University
(931) 221-6118, xiongp@apsu.edu

Undergraduate Research Advisors:**Sergei Markov**

Professor, Department of Biology
Austin Peay State University
(931) 221-7440, markovs@apsu.edu

Roman Holovchak (Golovchak in print)

Professor, Department of Physics, Engineering and Astronomy
Austin Peay State University
(931) 221-6361, holovchakr@apsu.edu

Character:**James Thompson**

Professor, Department of Biology
Austin Peay State University
(931) 221-6286, thompsonj@apsu.edu

RELEVANT COMPLETED COURSEWORK

Graduate

Duke

PHYSICS 761 Classical Mechanics (Classical Mechanics: Goldstein , Theoretical Mechanics of Particles and Continua: Fetter /Walecka)

PHYSICS 762 Electrodynamics (Electrodynamics: Jackson)

UNCG

NAN 700 Principles of Nanoscience I

NAN 706 Principles of Nanoscience II

NAN 707 Lab Protocols and Practice

NAN 710 Scientific Integrity

NAN 727 Principles of Quantum and Solid State Physics (Intro to Solid State Physics: Kittel)

NAN 708 Science Communications

NAN 749 Introduction to Spectroscopic Methods in Nanoscience

Undergraduate

PHYS 3005 Theoretical Methods (Div Grad Curl: Schey, Advanced Engineering Mathematics: Zill)

PHYS 3010 Intermediate Mechanics (Analytical Mechanics: Fowles /Cassiday)

PHYS 3030 Electricity and Magnetism I (Intro to Electrodynamics: Griffiths)

PHYS 3100 Optics (Optics: Hecht)

PHYS 3101 Optics Lab

PHYS 3250 Topics in Relativity

PHYS 3550 Experimental Methods (Building Scientific Apparatus: Moore)

PHYS 3551 Experimental Physics Lab

PHYS 3700 Introduction to Modern Physics (Modern Physics: Rex /Thornton)

PHYS 3701 Advanced Lab

PHYS 3800 Quantum Mechanics (Intro to Quantum Mechanics: Griffiths /Schroeter)

PHYS 4000 Computational Methods

PHYS 4001 Computational Methods Lab

PHYS 4200 Introduction to Solid State Physics (Solid State Physics: Ashcroft /Mermin)

PHYS 4201 Introduction to Solid State Physics Lab

CHEM 1110 General Chemistry

CHEM 1111 General Chemistry Lab I

CHEM 1120 General Chemistry

CHEM 1121 General Chemistry Lab II

CHEM 3510 Organic Chemistry

CHEM 3511 Organic Chemistry Lab

CHEM 3520 Organic Chemistry

CHEM 3521 Organic Chemistry Lab

MATH 1530 Elements of Statistics

MATH 1730 Precalculus

MATH 1910 Calculus and Analytic Geometry I

MATH 1920 Calculus and Analytical Geometry II

MATH 2110 Calculus

MATH 3120 Differential Equations I (Honors)
MATH 3130 Differential Equations II (Honors)
MATH 4321 Intro to Symbolic Computation

BIOL 2010 Human Anat and Physiology
BIOL 2011 Human Anat and Physiology Lab
BIOL 4120 Plant Physiology
BIOL 4121 Plant Physiology Lab
BIOL 4440 Cell and Molecular Biology
BIOL 4441 Cell and Molecular Biology Lab
BIOL 4080 General Ecology
BIOL 4081 General Ecology Lab
BIOL 3330 Principles of Evolution
BIOL 3331 Principles of Evolution Lab
BIOL 4130 Genetics
BIOL 4131 Genetics Lab
BIOL 3070 Botanical Diversity
BIOL 3071 Botanical Diversity Lab
BIOL 3060 Zoological Diversity
BIOL 3061 Zoological Diversity Lab
BIOL 3050 Microbial Diversity
BIOL 3051 Microbial Diversity Lab
BIOL 4300 Bacteriology
BIOL 4301 Bacteriology Lab
BIOL 4290 Scanning Electron Microscopy