

Varun G. Paul, PhD

Assistant Professor

Department of Geosciences
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PROFESSIONAL PREPARATION

Missouri University of Science & Technology	PhD	Geological Science	2014
Missouri University of Science & Technology	MS	Applied & Environmental Biology	2009
St. Peter's Engineering College (Anna University)	B. Tech	Industrial Biotechnology	2007

PROFESSIONAL EXPERIENCE

Department of Geosciences, Mississippi State University Aug 2016-present
Assistant Professor

Teaching (graduate* and undergraduate level):

- Water Resources (GG 3613)
- Introduction to Environmental Geology (GG3133)
- Water Biogeochemistry (GG8633*)
- Physical Hydrogeology (GG 4613/6613*)
- Chemical Hydrogeology (GG 4623/6623*)
- Engineering Geology (GG 4153/6153*)

Research:

- Nutrient and metal monitoring and risk assessment
- Surface water and groundwater interaction in watersheds
- Microbial mat characterization using metagenomics and isotopic profiling
- Surface and subsurface biogeochemical analogues for astrobiological applications
- Soil health using cover crops and fertilization schemes

Service:

- Member of Materials Working Group and Energy Working Group at Mississippi State University
- Department of Geology, Mississippi State University: Seminar, Museum, & Diversity and Inclusion committee
- Advisor, Association of Environmental and Engineering Geologists (AEG) student chapter; Secretary, Lower Mississippi Valley (LMV) AEG section

Department of Geological Sciences, Missouri S&T Jan 2016-Jul 2016
Assistant Adjunct Professor

Teaching (undergraduate level): Introduction to Geochemistry (Geol 3410)

Research: Biogeochemical Investigation of Microbialites in a hypersaline lake in The Bahamas

Service: Leading high school students to field trips as part of 'Jackling Intro to Engineering' program

Engineering Consulting Services, Ltd., Virginia Sept 2014-Dec 2015
Field Inspector

Technical monitoring of environmental practices, inspection of building materials and soil used in foundations and construction, overseeing contractor and field staff and reporting

Department of Geology, Department of Biology, Missouri S&T

Jan 2008- Dec 2013

Graduate Research and Teaching Assistant

Research assistant for M.S. thesis and Ph.D. dissertation projects

- a) PhD Dissertation: Carbonate bio-mineralization- Implications for subsurface CO₂ sequestration
- b) MS Thesis: Halo-alkaliphilic microbial fuel cells along with wastewater treatment
- c) Field-trip associated investigations involving sample collection from hypersaline lakes, analysis and interpretation of data obtained from *in-situ* and laboratory measurements.
- d) Reporting to program sponsors, laboratory management, proposal writing and journal publication
- e) Mentoring undergraduate students and assisting faculty and graduate students in research projects and field trips

Teaching assistant

- a) Mineralogy laboratory- Training students to identify and distinguish various minerals by using specific properties. Grading exams and setting-up laboratory assignments
- b) Geochemistry field trips-Training students in the handling and working of portable geochemical equipment, and surface and subsurface *in-situ* water quality analysis and interpretation
- c) Microbiology laboratory-Lecturing and providing hands-on training to students about various general and advanced techniques in the field of microbiology.

Space Life Science Lab, Kennedy Space Center, FL

Jun 2010-Aug 2010

Intern, NASA Planetary Biology Internship

Investigated the effects of rising CO₂ on modern marine stromatolites. The project involved exposing stromatolites collected from Highborne Cays (The Bahamas) to varying levels of CO₂ and conducting a metatranscriptomics and microbial community analysis of the microbialites

Central Institute of Brackish water Aquaculture (CIBA), Chennai, India

Jan 2007-Apr 2007

Undergraduate Intern

Studied effects of ammonia on shrimp cultivation and explored ways to treat or remove excess ammonia. Project involved isolating of the gene responsible for ammonia removal from laboratory grown cultures of the microbial community obtained from the ponds

Central Leather Research Institute (CLRI), Chennai, India

Apr 2005-Jun 2005

Undergraduate Intern

Worked on the treatment of Cr (VI) from leather industry. Bacterial cultures were grown in bio-reactors with wastewater from leather industry supplied as the feed-stock solution. The role of bacteria in remediating Cr (VI) was investigated

PUBLICATIONS AND BOOK CHAPTERS

In Review

- Paul, V.G., Peacock, E., & Belk, R. Elemental Characterization of Freshwater Mussel Shells from Different River Systems in eastern North America using ICP-OES. *Environmental Archaeology*, *In review*
- Paul, V.G., Vattikutti, S., Dash, P., & Arslan, Z. Evaluating Hydrogeochemical Characteristics of Groundwater and Surface Water in the Upper Pearl River Watershed, USA. *Environmental Monitoring and Assessment*. *In review*

Published or In-press

- Wickramarathna S., Chandrajith R., Senaratne A., Paul V.G., Dash P., Wickramashinghe S., Li X., Briggs, P. Bacterial influence in the formation of Hematite: Implications for Martian Dormant Life. *International Journal of Astrobiology. In-press.*
- Gabitov, R., Migdisov, A., Nguyen, A., Hartesveldt, N.V., Perez-Huerta, A., Sadekov, A., Sauer, K. B., Baker, J., Paul, V.G., Caporuscio, F., Xu, H., & Roback, R.. (2021). Uptake of uranium by carbonate crystallization from reduced and oxidized hydrothermal fluids. *Chemical Geology* 564, 120054.
- Paul, V., Banerjee, Y., Ghosh, P., & Busi, S. B. (2020). Depthwise microbiome and isotopic profiling of a moderately saline microbial mat in a solar saltern. *Scientific Reports*, 10(1), 1-16.
- Paul, V.G., & Mormile, M.R. (2020). Potential Energy Production and Utilization Pathways of the Martian Subsurface: Clues from Extremophilic Microorganisms on Earth. In. (Eds. J. Seckbach, and H. Stan-Lotter), *Extremophiles as Astrobiological Models*, 291-315
- Paul, V.G., Sankar, M. S., Vattikutti, S., Dash, P., & Arslan, Z. (2020). Pollution Assessment and Land Use Land Cover Influence on Trace Metal Distribution in Sediments from Five Aquatic Systems in Southern USA. *Chemosphere*, 128243.
- Sankar, M. S., Dash, P., Lu, Y., Paul, V., Mercer, A. E., Arslan, Z.,...& Rodgers, J. C. (2019). Dissolved organic matter and trace element variability in a blackwater-fed bay following precipitation. *Estuarine, Coastal and Shelf Science*, 231, 106452.
- Paul, V.G., & Mormile, M.R. (2017). A case for the preservation of saline and hypersaline environments: a microbiological perspective, *FEMS Microbiology Ecology*, 93
- Paul, V. G., Wronkiewicz, D. J., & Mormile, M. R. (2017). Impact of elevated CO₂ concentrations on carbonate mineral precipitation ability of sulfate-reducing bacteria and implications for CO₂ sequestration. *Applied Geochemistry*, 78, 250-271
- Paul, V.G., Wronkiewicz, D.J. & Mormile, M.R., (2016), Characterization of microbialites and the ecosystem of Storr's Lake, San Salvador Island, in Glumac, B., and Savarese, M., eds., *Proceedings of the 16th Symposium on the Geology of the Bahamas and other Carbonate Regions*, Gerace Research Centre, San Salvador, Bahamas, p. 95-110
- Paul, V.G., Wronkiewicz, D.J., Mormile, M.R., & Foster, J.S., (2016), Characterization of water, microbial mats and microbialites in the hypersaline environment of Storr's Lake, The Bahamas, *Astrobiology* 16 (4), 282-300
- Paul, V.G., Mormile, M.R., Minter, S.D. & Treu, B.L., (2014), Ability of a haloalkaliphilic bacterium isolated from Soap Lake, Washington to generate electricity at pH 11.0 and 7% salinity, *Environmental Technology* 35(8), 1003-1011
- Wronkiewicz, D., Paul, V.G., Abousif, A., & Ryback, K., (2013), Geoscience perspectives in carbon sequestration-educational training and research through classroom, field, and laboratory investigations. University of Missouri System. DOI: [10.2172/1162097](https://doi.org/10.2172/1162097)
- Begemann, M.B., Mormile, M.R., Paul, V.G., & Vidt, D.J. Book chapter: Potential enhancement of biofuel production through enzymatic biomass degradation activity and biodiesel production by halophilic microorganisms. *Halophiles and Hypersaline Environments: Current Research and Future Trends*, Springer; 1st Edition, 2011

White papers

- Stamenković, V. et al., 2020. Deep Trek: Science of Subsurface Habitability & Life on Mars. A Window into Subsurface Life in the Solar System. <https://hdl.handle.net/20.500.11753/1678>
- Edwards, C.D., et al., 2020. Deep Trek: Mission Concepts for Exploring Subsurface Habitability & Life on Mars: A Window into Subsurface Life in the Solar System. <https://hdl.handle.net/20.500.11753/1677>

CONFERENCE ABSTRACTS (*presenting author)

- Chang, T.*, Feng, G., Adeli, A., Paul, V.G., Jenkins, J., Reginelli, D.B. Spatial Variability of Soil Chemical Properties Following Long-Term Poultry Litter Application. ASA Southern Branch 2021 Annual Meeting. 01/30/21 (Poster)
- Chang, T.*, Paul, V.G., Feng, G., Adeli, A., Tewolde, H. Impact of Poultry Litter on Soil Chemical Health in Four Agroecosystems in Mississippi. 2020 ASA-CSSA-SSSA International Annual Meeting. 11/09/20 (Poster)
- Paul, V.G.*, Chang, T., Feng, G., Adeli, A. Soil Health Assessment Methods: A Comparative Study. 2020 ASA-CSSA-SSSA International Annual Meeting. 11/09/20 (Oral-invited)
- Chang, T.*, Paul, V.G., Feng, G., Adeli, A., Brooks, J. Determining a Minimum Data Set for Assessing Soil Health in Mississippi. 2020 ASA-CSSA-SSSA International Annual Meeting. 11/09/20 (Oral-invited)
- Chang, T.*, Paul, V.G., Feng, G., Adeli, A., Tewolde, H. Impact of Poultry Litter on Soil Chemical Health in Four Agroecosystems in Mississippi. 2020 ASA-CSSA-SSSA International Annual Meeting. 11/09/20 (Poster)
- Banerjee, Y., Paul, V.G., Ghosh, P., and Bhanu, B.S. Depth-wise Microbiome and Isotopic Profiling of a Moderately Saline Microbial Mat in a Solar Saltern and Its Implications Towards for Planetary Science. Indian Planetary Science Conference (IPSC-2020). 02/19/20 (Poster)
- Paul, V.G.*, and Vattikuti, S. Discerning Hydrogeochemical Properties in the Groundwater and Surface Waters of the Upper Pearl River Watershed in Mississippi. AEG. 09/17/19 (Poster)
- Jimenez A.L., Nguyen A.V., Paul V.G., Migdisov, A.A., Roback R., and Gabitov R.I*. Evaluation of Uranium Entrapment by Apatite crystallization in hydrothermal fluid. Goldschmidt 09/30/19 (Poster)
- Wickramarathna S.*, Paul V.G., Dash P., Chandrajith R., Senaratne A., Wickramashinghe S., Li X., Brinckerhoff W., and Van Amerom F. Characterizing Organic and Inorganic Constituents in Hematite-rich Soils on Earth: Implications for Martian Shallow Subsurface Life. AbSciCon. 06/25/19 (Poster)
- Sankar, M. S., Dash, P., Lu, Y. H., Paul, V.G., Mercer, A. E., Arslan, Z. Application of multivariate statistics to geochemical and precipitation data to evaluate dissolved organic matter-trace element variability in a Coastal Bay, AGU, 12/10/18 (Poster)
- Kidiwela, M.*, Paul, V.G., Mercer, A., Skarke, A. Influence of Geomagnetic Fluctuations on Temporal Atmospheric Water Vapor Variability, AGU Virtual Poster Showcase, 12/10/18 (Poster)
- Vattikuti, S.*, Paul, V.G. Characterizing the Shallow Groundwater Quality of a Clay-Dominated Watershed in Central Mississippi, AGU Virtual Poster Showcase, 12/10/18 (Poster)
- Griffith, E.M., Wogsland, B., Li, Z., Wronkiewicz, D.J., Paul V.G., Fan, M., Fantle, M.S. Stable calcium, magnesium and carbon isotopic compositions of two modern Bahamian lake stromatolites. Goldschmidt. 08/12/18 (Poster)
- Wickramarathna S., Chandrajith R., Senaratne A., Wickramashinghe S., Paul V. and Dash P. Microbial diversity in hematitic bearing rock from tropical Sri Lanka. Goldschmidt. 08/12/18 (Poster)
- Kidiwela, M.*, and Paul, V.G. Influence of Geomagnetic Fluctuations on Temporal Atmospheric Water Vapor Variability. Summer Undergraduate Research Symposium. 08/01/18 (Poster)

- Vattikuti, S.*, and Paul, V.G. Characterizing the Groundwater Quality of the Upper Pearl River Watershed. MS Academy of Science Symposium. 07/26/18 (Poster)
- Paul, V.G. Microbial Diversity in the Hypersaline Mats of Solar Salterns in India. Gordon Research Conference-Geobiology. 01/21/18 (Poster)
- Sankar, M S.*, Dash, P., Paul, V., Singh, S., Lu, Y., Arslan, Z., Varco, J., Phipps, S., Rodgers, J. R. The Nature of Dissolved Organic Matter and its effect on Biogeochemical Cycling of Toxic Trace Metals in Weeks Bay Estuary. SEDAAG. 11/19/17 (Oral)
- Vattikuti, S. *, and Paul, V.G. The Hydrochemistry and Landuse/Landcover Classification of the Upper Pearl River Watershed in Central Mississippi. SEDAAG. 11/19/17 (Oral)
- Vattikuti, S. *, and Paul, V.G. Characterizing the Groundwater of the Upper Pearl River Watershed in Central Mississippi. GSA Annual Meeting, Seattle, Washington. 10/25/17 (Poster)
- Griffith, E. *, Li, Z., Gaines, E., Wronkiewicz, D., Paul, V.G., Fan, M. and Fantle, M. First Measurements of Magnesium Isotopic Compositions of Two Modern Bahamian Island Lake Stromatolites. GOLDSCHMIDT. 08/13/17 (Poster)
- Li, Z*, Griffith, E. M., Gaines, E., Wronkiewicz, D. J., Paul, V.G. and Fan, M. Geochemistry of Microbialites and Water in Storr's Lake, San Salvador, Bahamas, 51st South-Central Section-GSA Annual Meeting. 03/14/17 (Oral)
- Paul, V.G., Wronkiewicz, D.J., and Mormile, M.R., Biogeochemical Cycling and Microbial Diversity in the Microbialites of Storr's Lake, Bahamas, American Society of Microbiology, Columbia, Missouri. 03/23/13 (Oral)
- Paul, V.G., Wronkiewicz, D.J., and Mormile, M.R., Microbialites in the Hypersaline, Light-limiting Waters of Storr's Lake, Bahamas, Gordon Research Seminar and Conference (Geobiology), Ventura Beach, CA. 01/26/13 (Poster)
- Paul, V.G., Wronkiewicz, D.J., and Mormile, M.R., A Biogeochemical Investigation of the Ecosystem and the Microbialites in Storr's Lake, San Salvador Island, Bahamas, Geological Society of America Annual Meeting and Exposition, Charlotte, North Carolina. 11/04/12 (Poster)
- Wronkiewicz, D.J. *, and Paul, V.G., Mineral and Chemical Characteristics of Microbialites from Storr's Lake, San Salvador Island, Bahamas, 16th Geology Conference, Gerace Research Center, Bahamas. 06/14/12 (Oral)
- Paul, V.G., Wronkiewicz, D.J., and Mormile, M.R., Characterization of Microbialites and The Ecosystem of Storr's Lake, San Salvador Island, 16th Geology Conference, Gerace Research Center, Bahamas. 06/14/12 (Oral)
- Paul, V.G., Wronkiewicz, D.J., and Mormile, M.R., Sulfate Reducing Bacteria and Their Potential Role in CO₂ Sequestration, American Society of Microbiology Warrensburg, Missouri. 03/31/2012 (Oral)
- Paul, V.G., Wronkiewicz, D.J., and Mormile, M.R., Biomineralization of Carbonates in Modern Microbial Sediments, Geological Society of America Annual Meeting and Exposition, Minneapolis, Minnesota. 10/09/11 (Oral)
- Paul, V.G., Wronkiewicz, D.J., and Mormile, M.R., Biomineralization of Carbonates in Modern Microbial Sediments and its Applications in CO₂ Sequestration, AIPG National Conference, Bloomingdale, Illinois. 09/10/11 (Oral)
- Paul, V.G., and Mormile, M.R., Microbial Fuel Cell: Electricity and Bacteria, 44th ACS Midwest Regional Meeting. 10/21/09 (Oral)

LECTURES AND WORKSHOPS

- Grant Proposal Writing Workshop, Mississippi State University 2020
- Subsurface Biospheres on Mars, Session Co-Chair, AGU AbSciCon 2019
- 35th Southern Biomedical Engineering Conference (Invited talk) 2019
- NSF workshop for early career faculty, Mississippi State University 2018
- Maroon Institute of Writing Excellence, Mississippi State University 2018
- Energy Working Group (Invited Lecture), Mississippi State University 2018
- Early Career Geoscience Faculty Workshop: Teaching, Research, and Managing Your Career 2017
- Department of Geology, University of Mississippi-Oxford (Invited Lecture) 2017
- Centre for Earth Sciences, Indian Institute of Science, Bengaluru, India (Invited lecture) 2017
- SEC Conference: Future of Water, Starkville, MS 2017
- Materials Working Group (Invited Lecture), Mississippi State University 2017
- Brown Bag Lunch Seminar, Department of Geosciences, Mississippi State University 2016
- Environmental Research Center (Invited Lecture), Missouri S&T 2016
- Environmental Research Center (Invited Lecture), Missouri S&T 2013
- NSF Workshop on the Geothermal Potential of Sedimentary Basins 2011

RESEARCH GRANTS (select examples)

- NSF AISL INNOVATION IN DEVELOPMENT: Virtual Investigations in the Singing River (Pascagoula) Watershed (Virtual Singing River), \$2,999,323 (Co-PI, pending, 2021)
- MSU ORED Undergraduate Research Program: Biochar-based Water Filter, \$1,966 (funded), 2020
- Gulf Coast Association of Geological Societies: Assessing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ isotopic signatures in the Pascagoula bay system to evaluate paleoenvironmental conditions and sea-level changes, \$2,500 (funded), 2020
- EPA STAR: Removing Nitrate and Phosphate from Runoff and Baseflow using Low-cost, Engineered Biochar, \$937,912 (Co-PI, unfunded, rated 'Good') 2019
- NSF AISL INNOVATION IN DEVELOPMENT: Virtual Investigations in the Singing River (Pascagoula) Watershed (Virtual Singing River), \$2,999,323 (Co-PI, unfunded, rated 'Competitive') 2019
- NSF: Engineering Biochar – Low cost adsorbents for nitrate and phosphate nutrients for landscape architecture applications, \$349,966 (Co-PI, unfunded, rated 'Good'), 2018
- NSF CAREER: A Holistic Approach to Study Combined Organic and Inorganic Carbon Fluxes in Soils due to Elevated Carbon dioxide: Implications for Soil Acidification, \$476,303 (PI, unfunded, rated 'Good'), 2018

AWARDS AND SCHOLARSHIPS

- AEG Young Professional Travel Grant, \$500 2019
- Minority Faculty Writing Grant, Mississippi State University, \$250 2019
- Geology and Geophysics, Jeffrey Spooner Outstanding Graduate Scholar, Missouri S&T, \$500 2013
- Annual Graduate Student Showcase, Missouri S&T. Third Place, \$150 2013
- Geology and Geophysics, Outstanding Graduate Scholar (honorable mention) 2012
- Gordon Research Conference and Seminar, \$ 500 2012
- Graduate Student Showcase, Missouri S&T. Second Place, \$300 2012
- Geology and Geophysics Scholarship. Missouri S&T, \$100 2011
- AIPG-AIH National Conference. Student scholarship, \$100 2011
- Graduate Student Showcase, Missouri S&T. Third place, \$150 2009
- NASA Planetary Biology Internship, Kennedy Space Center, \$3200 2010

MENTORED STUDENT AWARDS

- Ramon Richardson, Undergraduate student, NEMDJ Research award (\$500), Dec 2018
- Maleen Kidiwela, Undergraduate student, Summer Fellowship, Honors Undergraduate Research Program (\$1,396), Apr 2018; NEMDJ Research award (\$400), Feb 2018
- Shannon Vattikutti, Graduate Student, A&S Graduate Student Travel Support (\$400)

SYNERGISTIC ACTIVITIES

- Review Panel, NASA Exobiology Program, 2019 & 2020
- Cultural Awareness Training-Panel member, International Services, Mississippi State University, 2019
- Museum & Diversity and Inclusion Committee, Department of Geosciences, Mississippi State University, 2019-present
- Secretary, Association of Environmental and Engineering Geologists (AEG), Lower Mississippi Valley chapter, 2019
- Mississippi State University Search Committees: Associate Director, Office of Institutional Diversity and Inclusion, (2019), Geology faculty, (2019), Geology department head (2018)
- Judge for AGU Virtual Poster Showcase, 2018
- Judge for Mississippi Academy of Sciences Conference, Mississippi State University, 2018, 2019
- Judge for Plants and Animal Science Department Symposium, Mississippi State University, 2018
- Judge for Undergraduate Research Symposium-Mississippi State University, 2017, 2018, 2020
- Teaching Assistant Workshop Evaluator, Mississippi State University, 2017
- Judge for Region V Mississippi Science and Engineering Fair, Mississippi State University, 2017
- Reviewer for *Environmental Monitoring and Assessment Journal*, 2017
- Reviewer for *Hydrological Processes Journal*, 2016-present
- Reviewer for *Journal of African Earth Sciences*, 2016-present
- Judge for Undergraduate Research Conference, Missouri S&T, 2016

PROFESSIONAL AFFILIATIONS

- Global Learning and Observation to Benefit the Environment (GLOBE) program
- Consortium of Universities for the Advancement of Hydrologic Science, Inc. (CUAHSI)
- Water Resources Research Institute (WRI)
- Association of Environmental and Engineering Geologists (AEG)
- Geological Society of America (GSA)
- American Society for Microbiology (ASM, past)
- American Association of Petroleum Geologists (AAPG)

ACADEMIC/INSTITUTIONAL AFFILIATIONS

External Collaborators

Gary Feng (USDA, Starkville), David Wronkiewicz (Missouri University of Science and Technology, Ph.D. Advisor), Melanie Mormile (Missouri University of Science and Technology, M.S. and Ph.D. Advisor), Xiang Li (NASA Goddard Space Flight Center, University of Maryland, Baltimore), Emmitt Witt (USGS, Rolla), Honglan Shi (Missouri University of Science and Technology), Jamie Foster (University of Florida-Gainesville, NASA), Jeannie Barlow (USGS), Prosenjit Ghosh (Indian Institute for Science, Bengaluru, India), Yogaraj Banerjee (Indian Institute for Science, Bengaluru, India), Busi Susheel Bhanu (University of Luxembourg, Luxembourg)

Student Mentorship (*graduated, †Mississippi State University)

Dissertation/Thesis and Visiting Scholar, Main Advisor

Tingting Chang (Visiting Scholar)	Daniel Makowsky (MS [†] , Geology)
Jannatul Ferdush (Ph.D. [†] , Geology)	Austin Brister (MS [†] , Geology)
Shannon Vattikutti (Ph.D. [†] . and MS*, Geology)	Ben Taylor (MS [†] , Geology)
Charlie Bills (MS [†] , Geology)	Emma Tucker (MS [†] , Geology)
Mac Temple (MS [†] , Geology)	(MS [†] , Geology)

Dissertation/Thesis Committee Member

PhD, Earth and Atmospheric Science

Courtney Killian^{*†}
Angel Jiminez[†]
Scott Dykes[†]
Derek Anderson[†]
Maurice Testa^{*†}
Van Anh Nyugen[†]

MS, Geology

Van Anh Nyugen*
Lauren Parker^{*†}
Kristina Delia^{*†}
Sudeera Wickramarathna^{*†}
Brendan Lomago^{*†}
Tim Palmer^{*†}
Daniel Adcock^{*†}
Allison Bohanon[†]
Kevin Branigan[†]

Undergraduate Research Advisor

Geology: Ashton Martin[†], Reagan Belk^{*†}, Connor Kitchens^{*†}, Ramon Richardson[†], Matt Berry^{*†}, Maleen Kidiwela^{*†}, Katherine Herries* and Kayla Haneline* (Missouri University of Science and Technology),
Chemical Engineering: Jordan Caskey^{*†}