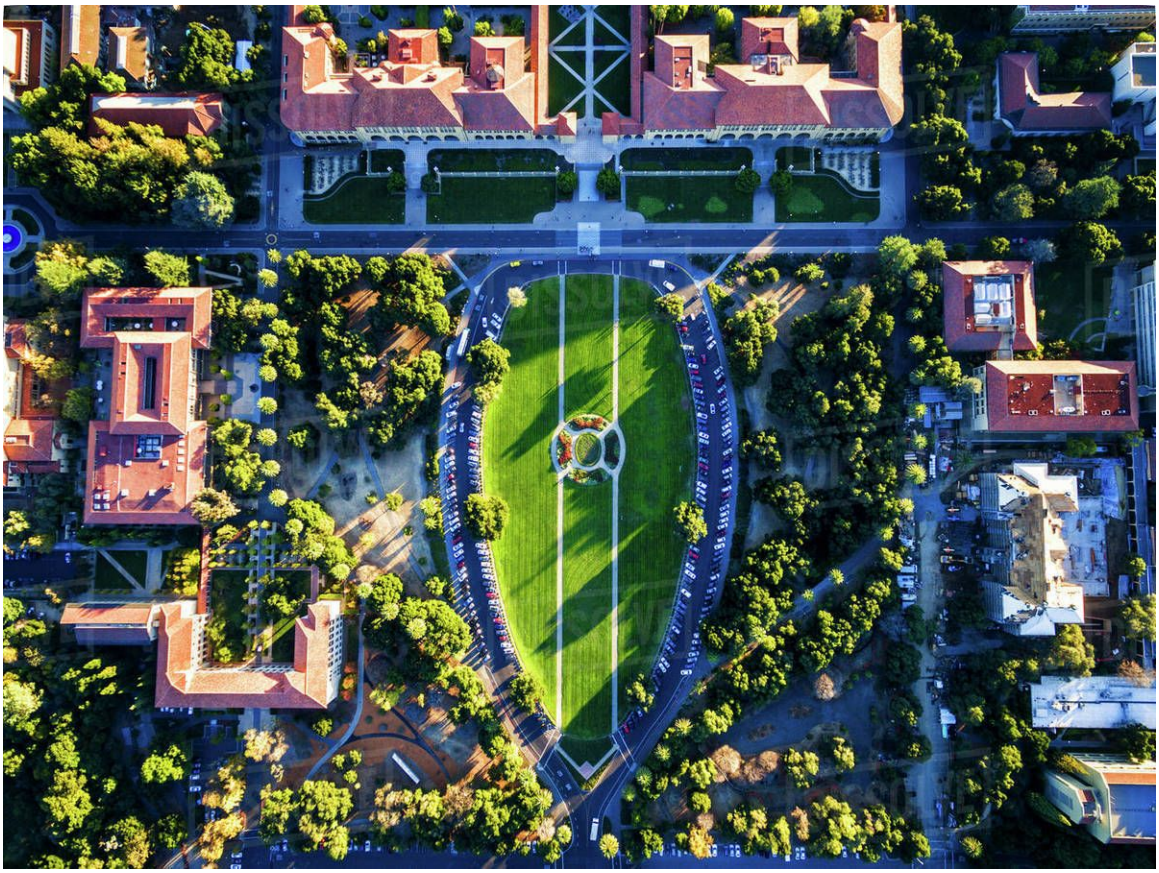
Adam's Graduate School Application Guide
Supplementary Information



Compiled by:

Adam Michael-Anthony Simpson

PhD Student at Stanford University

Environmental Engineering Program

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Example Curriculum Vitae

Adam Simpson

Current Address:

YOUR UNDERGRAD ADDRESS or WORK ADDRESS
Phone: (###) ###-####
your-email@institution.edu/com

Permanent Address:

YOUR HOME ADDRESS IF NOT THE SAME AS CURRENT ADDRESS

To format you Curriculum Vitae Just delete the red font

EDUCATION:

Undergrad Institution, City, State — Major GPA (#.##/4.0) – Overall GPA (**#.##**/4.0) – Dec 2015.
Bachelor of Science/Arts in Major — Month Year
(Honor Society Membership if applicable)

EX

Carnegie Mellon University, Pittsburgh, PA — Major 3.84/4.0 - **3.79**/4.0 – Dec 2015.
Bachelor of Science in Chemical Engineering — May 2016
(Tau Beta Pi)

TECHNICAL SKILLS:

- **Generate an exhaustive list**

Computer Skills:
Laboratory Skills:
Language Skills:

EX

Computer Skills:
Proficient in Matlab Coding, ChemSketch, Chembiodraw and Python.

Laboratory Skills:
Complexometric Titrations, Acid-Base Titrations, Redox Titrations, Iodometric Titrations, Iodimetric Titrations, Standard preparation and analysis using UV/Vis Spectrometry, High Performance Liquid Chromatography (HPLC) and Atomic Absorption Spectroscopy, Preparation and analysis of Organic

Compounds, Thin Layer and Column Chromatography (Isocratic and Gradient), Rotary Evaporation, High Vacuum usage, Base bath preparation, Ninhydrin solution preparation, NMR, ESI-MS, (LC/MS) mass spectrometry, Chemical and Apparatus Sourcing.

Language Skills:

Jamaican Creole (Patois)

RESEARCH EXPERIENCE:

Research Institution name, City, State/Country.
Research Program Name
Research Title: Month Year – Month Year
List of Research skills developed using action verbs

EX

Kiel University, Otto Diels Institute of Organic Chemistry, Kiel, Germany.
DAAD Rise Summer Research Internship,
Researcher: June 2015 – August 2015

- Performing Microwave assisted Semi-automatic Solid Phase Protein Synthesis
- NMR shimming, development and interpretation of 1D and 2D scans (NOESY, HSQC, COSY, TOCSY, ROESY, HMBC)
- Purification RV-HPLC, PLRP-S stationary phase, gradient Water/Acetonitrile mobile phase.
- Qualitative determination via Mass Spectrometry.

Carnegie Mellon University Department of Chemistry, Pittsburgh, PA
Researcher: September 2014 – Present

- Performing the synthesis of Peptide Monomers for Solid Phase synthesis using Native Chemical Ligation.
- Synthesis Protocols include Swern Oxidation or Mitsunobu Reaction and De-protection, Reductive Amination/Imine Coupling, Reduction of Carboxylic acids, Peptide Coupling, Ester Hydrolysis and partial G-Nucleobase synthesis.
- Progress: Produced Boc-Leu-PNA-C Monomer, Boc-Phe-PNA Cyt Monomer, Boc-Ile-PNA-G Monomer and Boc-Val-PNA G Monomer.

Carnegie Mellon University Department of Chemistry, Pittsburgh, PA
Howard Hughes Medical Institute Summer Undergraduate Research Program (HHMI)
Researcher May 2014 – August 2014

- Performed the synthesis of Peptide monomers for Solid Phase synthesis using Native Chemical Ligation.
- Synthesis Protocols include Swern Oxidation or Mitsunobu Reaction and De-protection, Reductive Amination/Imine Coupling, Reduction of Carboxylic, Peptide Coupling and Ester Hydrolysis.

Independent Research Project, Pittsburgh, PA
Molecular Design Grand Challenge, Carnegie Mellon University
Researcher January 2014 – May 2014

- In a team of 9 students to enhance the protease inhibitor drug "Fosamprenavir"
- Hypothesized upon three possible alterations of the drug to treat specific Protease mutants

- After Simulations on molecular software "Pymol" were made, task was to generate reaction mechanisms and protocols
- Established an economical analysis on reaction protocols and contributing chemicals.
- Work received recognition from HIV Specialist, Dr. Amesh Adalija.

PROPOSALS:

Name your proposals following this example.

EX

Carnegie Mellon University Small Undergraduate Research Grants (SURG), "Development of Broad-Spectrum Antibiotics" January 2015 – May 2015.

PRESENTATIONS:

Publications (Using common citation style for your field or APA format)
Conferences (Using common citation style for your field or APA format)
Posters (Using common citation style for your field or APA format)

EX

Conferences

- "Observing the Stabilizing effects of the Trp-Cage (tc10b) mini-protein on the Amoebapore A HII protein sequence" presented at the 2015 RISE Heidelberg Meeting, Heidelberg University, Heidelberg, Germany.

Posters

- "RTD-1M: Modifications to the Backbone by Introducing Hydrophobic Side Chains Derived from Existing Glycolipopetide Antibiotics," presented at the HHMI Summer Undergraduate Research Program Symposium, Howard Hughes Medical Institute Summer Undergraduate Research Program, Mellon Institute; Fifth Avenue, July 2014.
- "Development of Broad-Spectrum Antibiotics" presented at the Meeting of the Minds-Undergraduate Research Symposium" Carnegie Mellon University CUC, Forbes Avenue, May 2015.

ACADEMIC AWARDS:

List your academic awards in order of chronological order

EX

- Tau Beta Pi Engineering Honor Society, Spring 2015.
- Molecular Design Grand Challenge Winners, Spring Semester 2014
- Carnegie Institute of Technology, Dean's List, Spring Semester 2014
- Carnegie Institute of Technology, Dean's List, Fall Semester 2013
- Carnegie Institute of Technology, Dean's List, Fall Semester 2012

SCHOLARSHIPS:

List your Scholarships in chronological order. You may or may not include the total funds awarded.

EX

- DAAD Rise Summer Research Internship - Summer 2015, $1830.78
- Howard Hughes Medical Institute (HHMI) Summer Undergraduate Research Program at Carnegie Mellon University, $4000.00, May 2014 – August 2014

GRANTS:

List the grants that you have proposed and received funds for. You may or may not include the total funds awarded.

EX

- Carnegie Mellon University Small Undergraduate Research Grants (SURG), $1000.00, January 2015 – May 2015. "Development of Broad-Spectrum Antibiotics".
- Carnegie Institute of Technology (CIT), Carnegie Mellon University, Travel Grant recipient $750.00, June 2015 – August 2015
- Tartans Abroad Grant, Carnegie Mellon University, $450.00, June 2015 – August 201

WORK EXPERIENCE:

Name of Company, City, State/Country
Title of Internship position, Month Year – Month Year
List of responsibilities using action verbs and numbers to quantify your productivity

EX

PETROJAM ltd, Kingston, Jamaica, British West Indies
Oil Refinery, Process Engineering, Oil Loss Control Department Intern, May 2013 – July 2013

- Compiled Calibration Report data for 22 Custody Transfer Meters over the span of 3-5 years
- Re-organized Calibration Reports into a chronological filing system for the Loading Rack Technicians
- Produced a Database of greater than 5,000 Meter Factors for the Oil Loss Control Department
- Generated 22 Control Charts for the Meter Factor data obtained from Calibration Reports
- Coordinated a presentation on the Control Charts generated from the Meter Factors
- Established a current database for the 38 Pressure Safety Valves (PSVs) on the refinery
- Checked for leakages on PSVs using the Explosivity Meter, reporting those within ranges 50-100%.

CARNEGIE MELLON UNIVERSITY, Pittsburgh, Pa
Residential Assistant for Fairfax Apartments, August-2013 – Present

- Ensure the safety and well being of 40 upper-class students for each Academic year
- Ensure that the integrity of the apartment floor is up to school standards
- The direct liaison between the student life services and the student tenants

- Coordinate, market and advertise events and important information
- Plan professional and social programs to ensure the development of student tenants

VOLUNTEER EXPERIENCE:

Institutions are stressing the need to demonstrate your devotion to helping others and pursuing outreach activities. Please include any relevant experiences.

Volunteer/Outreach Initiative, City, State/Country
List of volunteering responsibilities

EX

Southside Slopes Cleanup, Pittsburgh, PA
- Member of Residential Assistant service team
- Cleaned polluted areas of plastic bottles
- Cut down overgrowth that impeded walkways

EXTRACURRICULAR ACTIVITIES & Memberships:

List of your extracurricular activities

EX

- Member of the Carnegie Mellon University **Tau Beta Pi** Engineering Honor Society
- Member of the Carnegie Mellon University National Society for Black Engineers **(NSBE)**
- Member of the Carnegie Mellon University A capella group “The Treblemakers”

Example Graduate School Application Personal Statement 1.

Within my graduate career I hope to develop a research plan that will positively impact both the US and Jamaica. I will do this by developing natural water treatment systems, in the US and Jamaica and incorporate the works of professors: Erich Hester, Mark Widdowson and John Little. My interests in environmental engineering were primed in the recent increases in NO_3^- within both US and Jamaican water supplies caused from agricultural runoff and wastewater effluents.

There are pending stricter regulations on nutrient discharges in water. Furthermore, effluent sourced from wastewater treatment plants and agricultural runoff has resulted in the increase of NO_3^- pollution[1]. Traditional removal by ion-exchange systems requires large energy costs and replenishment of synthetic substrates with the added barrier of increased green house gas emmisions[2]. A viable alternative is engineered water treatment wetlands. Successful vegetated systems are increasingly being installed in temperate regions of the US in states including Florida, Texas, California and North Carolina[2, 3]. Furthermore, wetlands with residence times of 3-6 days are believed to be as effective as ion-exchange systems, with little to no energy consumption[1]. However there remain multiple issues concerning denitrification seasonality, predictability and modelling[1].

Research shows that shallow wetlands that incorporate geotextile fabrics facilitate denitrification rates that exceed those of more traditional vegetated systems while enabling photolysis and biodegradation of water pollutants such as endocrine disruptors and pharmaceticals[3]. Though currently deployed as a 2-D liner, my choice of research

would focus on porous plastic fibers with high surficial area deployed as inert geotextile supports. The system will be designed such that peripheral and interior zones within the biomat may be removed for biochemical and microbiological inquiry of the biofilm[5] that forms in the system. The incorporation of the geotextiles to facilitate microbial growth and enhanced hydrologic flowpaths in combination with more traditional wetland structural features will enable both effective treatment and its utilization as a system intervention tool for denitrification mechanistic studies.

After obtaining my PhD I hope to develop an engineering consortium between engineers in the US and Jamaica. The goal is to adapt these low cost and energy demanding, naturally inspired water treatment systems to the nation that is beginning to have increased prevalence of NO_3^- pollution. By opening this research consortium I hope to develop satellite projects in Jamaica, which will advance the broader impacts of researchers in the US, as well as harness better and more affordable environmental practices in Jamaica. The consortium could also target other industries such as ecotourism. For example, water treatment wetlands are known to purify water, provide recreational and aesthetic pleasure, and habitat benefits. Furthermore, environmental researchers could investigate environmental processes within a region of a different geological and climatic makeup. Encouraging a development of volunteer community engagement via tourism and student centric projects through collaborations with US universities.

In general, graduate school is the first step I must take for a research career in Civil and Environmental Engineering. Continuing my education at **Institution Name** with minds such as the professors Professor A, Professor B and Professor C will aid me fulfill my life's goals in creating sustainable and naturally inspired water treatment wetlands within Jamaican and the US. Furthermore, the academic achievements I will

make at **Institution Name** will foster a great collaborative network for my future academic career. With an extensive faculty with minds that are amongst the top in the country within a top ranked program, I do believe that obtaining my PhD will make me achieve my goals and help me acquire the knowledge I need to do so. In all, I believe that **Institution Name** is the right first step for my career in Civil and Environmental Engineering.

References

1. Jasper, Jones, Sharp & Sedlak. Nitrate Removal In Shallow, Open-Water Treatment Wetlands. *Environ. Sci. Technol.* **2014**, 11512–11520.
2. Cunningham, Sharp, Hiebert & James. Subsurface Biofilm Barriers For the Containment and Remediation of Contaminated Groundwater. *Bioremediation Journal*. **2010** 151–164.
3. Jasper, Nguyen, Jones, Ismail, Sedlak, Sharp, Luthy, Horne & Nelson. Unit Process Wetlands For Removal of Trace Organic Contaminants and Pathogens …Wastewater Effluents. *Environ. Sci. Technol.* **2013**, *30*, 421–436..
4. Boelee, Janssen, Temmink, Shrestha, Buisman & Wijffels. Nutrient Removal And Biomass Production in an Outdoor Pilot-Scale Phototrophic Biofilm Reactor for Effluent Polishing. *Appl Biochem Biotechnol* **2013**, 405–422.
5. Flemming & Wingender. The Biofilm Matrix. *Nature Reviews Microbiology*. **2010**, *8*, 623–633.

Example Graduate School Application Personal Statement 2.

Institution Name – Program
Adam Michael-Anthony Simpson
Statement of Purpose

As a dual citizen, I was born in Jamaica, to a family of engineers who own and operate a company, "Jamaica Wells and Services Limited." It is a private engineering company which designs and drills wells for water. As a youth I became invested in the actions of our business. Many summers of my adolescence were spent shadowing the engineers of the company, which inspired my path in engineering. One particular experience was my prolonged observation of a project, in the summer of 2009, to bring a large and dependable supply of water to the smallholding farmers of the "New Forest" area of St. Elizabeth, Jamaica. This government-funded project was designed to improve the infrastructural supply of water for farmers who relied on natural means of attaining water. My family's company drilled five wells and designed, supplied and installed the pumping systems needed for the irrigation needs of the farms. Since our involvement with New Forest, the farmers have thrived. This galvanized my interests in engineering, particularly in ways that positively impacts society.

My first experience with research was the product of my interests in Organic Chemistry II taken with Professor Danith Ly. I was captivated by the process of solving synthesis schemes by having an understanding of chemical group functionality and realizing molecular relationships. I therefore decided to join his research group as a sophomore, and I am presently a member taking part in a project led by undergraduate students to "Develop a New Family of Broad-Spectrum Antibiotics". The project is centered on RTD-1 a defensin that was isolated from the leukocytes of baboons and rhesus macaques that demonstrates antimicrobial character. Our undergraduate team is concerned with improving the effective concentration of RTD-1M, a molecular mimic of RTD-1, by attaching hydrophobic tails as a bacterial membrane anchoring molecular component. My experience in the Ly group has developed my ability to independently take control of a research project and obtain valuable results thus fostering my promotion by Professor Ly as project leader with four undergraduate collaborators. My responsibility was to maintain the consistency of work efforts within the undergraduate group and ensure the efficacy of synthetic schemes.

Due to the analytical nature of our project and my interests in working and learning in another culture I applied for and attained a summer research scholarship in Kiel, Schleswig-Holstein, Germany with the Frank Sönnichsen group. The protein-engineering project I worked on was focused on, "Observing the stabilizing effects of the Tryptophan-Cage (Trp-Cage) Protein on the Amoebapore A -Helix II". The motivation of the project was to observe the efficacy of a chimer approach to stabilizing the Amoebapore A -Helix II protein so that one day an antimicrobial drug could be developed. This gave me the experience of taking part within research in a new

environment, thus honing my skills in achieving results while maneuvering through a new research setting.

The past three years of my college career have honed my skills of responsibility and academic stamina. For the past two years of my college career I have worked as a residential assistant, which has responsibilities lasting over 20 hours a week. Due to my determination to do research I decided to incorporate my laboratory duties into my academic schedule, which in total took over 18 hours per week. I therefore learned how to manage my time as a student, residential administrator, peer advisor, liaison between residents and the student life offices, and as a budding scientist perfecting my research skills. By planning science and engineering events I learned how to engage students involved in STEM, a skill that I see useful in the future. I was therefore very pleased in acquiring recognition of my hard work by my inauguration into the honor society Tau Beta Pi.

Within my graduate career I hope to develop a research plan that will positively impact both the US and Jamaica. This will be done by developing natural water treatment systems, in the US and Jamaica. My interests in environmental engineering were primed in the works of my parents well drilling company and the recent increases in NO_3^- within both US and Jamaican water supplies caused from agricultural runoff and wastewater effluents. This issue is particularly prominent in urban areas of both the US and Jamaica, hence it has become the object of my research interests. After obtaining my PhD centered on denitrifying water treatment wetlands, I hope to develop an engineering consortium between engineers in the US and Jamaica. The goal of this is to adapt these low cost and low energy demanding, naturally inspired water treatment systems to the nation that is beginning to have increased prevalence of NO_3^- pollution. By opening this research consortium I hope to develop satellite projects in Jamaica, which will advance the broader impacts of researchers in the US.

In general, I believe that a graduate's degree in environmental engineering at **Institution Name** is the best step towards my planned career. Particularly under the guidance of Professor A and Professor B, I will obtain knowledge in biological treatment techniques for wastewater, remediation of waste sites and groundwater contamination. This will help me earn the required research skills to create sustainable and naturally inspired water treatment processes in Jamaica and expand the impact of researchers in the US to a country in need of sustainable environmental remediation developments. Furthermore with research faculty boasting some of the top minds of the US, I will have tremendous opportunity to develop and expand my research collaboration network to foster a consortium of engineers between researchers in both the US and Jamaica. In all, I believe that pursuing my PhD at **Institution Name** is the best first step towards my career and research plan in environmental engineering.

Example Graduate School Application Personal Statement 3.

This personal Statement had two parts.

Part 1 - Personal History

Institution Name
Adam Simpson
Personal History

As a dual citizen, I was born in Jamaica, to a family of engineers who own and operate a company, "Jamaica Wells and Services Limited." It is a private engineering and construction company which designs and drills wells for water. It has most recently expanded to provide potable water to both private customers and the local municipality through the, "National Water Commission" serving over 30,000 people. As a youth I became invested in the actions of our business. Many summers of my adolescence were spent shadowing the engineers of my family's company, which inspired my educational path in engineering. One particular experience was my prolonged observation of a project, in the summer of 2009, to bring a large and dependable supply of water to the smallholding farmers of the "New Forest" area of St. Elizabeth, Jamaica. This government-funded project was designed to improve the infrastructural supply of water for farmers who relied on natural means of attaining water to supply their farms. My family's company drilled five wells at a depth of 500 ft and 16 in diameter. We also designed, supplied and installed the pumping systems needed for the irrigation needs of the farms. Since our involvement with New Forest, the farmers have thrived, supplying a larger yield of crops, further advancing the quality of lives in the area. The success of this project galvanized my interests in engineering, particularly in ways that can positively impact a large number of people.

In high school, I developed an interest in Chemistry and because of this I sought for advanced knowledge through tutoring in the subject. The one on one attention in the subject area instilled confidence in the way I approached chemistry related subjects. This influenced my decision to major in Chemical Engineering when pursuing my Bachelors degree. I then became inspired to get my undergraduate education in the US due to the presence of large-scale engineering industry and most importantly the opportunities to take part in the highest caliber of research, which would allow me to investigate hypotheses that can develop technical approaches in a particular field. By attending University in the US, I would have the chance to be engaged in engineering programs that are both technically and scientifically robust. This along with my need for an international perspective in my education was why I decided to pursue an undergraduate education in the US.

After my freshman year, I decided that I wanted to get engineering experience from another perspective than my works with my parents company. I therefore applied for and attained an internship at PETROJAM Limited, Jamaica's only oil refinery, which supplies the energy needed by the nation. While stationed in the Oil Loss Control department, my major projects included testing the efficacy of 22 custody transfer meters at the refinery industrial loading rack. This included statistical analysis of the calibration reports performed on the custody transfer meters over a period of five years I progressed to make control charts to test the integrity of pumps that supplied oil tanker trucks. I also tested the integrity of the pressure safety valves (PSVs) on the tops of distillation columns on the production plant. Testing the 38 PSVs included using an explosivity meter to quantify the leakage capacities. Although water and petroleum differ in their impacts to the environment, they are similar for the population regarding perspectives, approaches and challenges. This experience made me fully comprehend the limitations of the resources available in Jamaica.

My first experience with research was the product of my interest in studying Organic Chemistry. When I was enrolled in the Organic Chemistry II class with Professor Danith Ly (an **Institution Name Postdoc Alumnus**), I was captivated by his enthusiasm for solving synthesis schemes by having an understanding of chemical group functionality and realizing molecular relationships. I therefore decided to join his research group as a sophomore, taking part in the Howard Hughes Medical Institute (HHMI) Summer Undergraduate Research Program. I am still a part of this research group with the project, led by undergraduate students to "Develop a New Family of Broad-Spectrum Antibiotics". The project is centered on RTD-1 a defensin that was isolated from the leukocytes of baboons and rhesus macaques that demonstrates antimicrobial character. Our group has since developed a mimic to RTD-1, denoted as RTD-1M, which instead of containing three characteristic disulfide bridges utilizes modified -peptide nucleic acid (PNA) with three coordinated base pairs as a method to supplant the three-disulfide bridges that are difficult to replicate. RTD-1M retains the same anti-microbial characteristics as RTD-1. Therefore, our undergraduate group is now concerned with improving the effective concentration of the drug by attaching hydrophobic tails as a bacterial membrane anchoring molecular component to RTD-1M.

My experience in the Danith Ly research group has developed my ability to independently take control of a research project and obtain valuable results. Progressing from the HHMI summer research experience, I was promoted by Professor Ly to be leader of the project, along with four other undergraduate collaborators. My responsibility was to maintain the consistency of work efforts within the undergraduate group and ensure the efficacy of synthetic schemes. As a team, we won a "Carnegie Mellon University Small Undergraduate Research Grant" for $1000.00 (2015). I also presented two posters on the progress of the project at the "HHMI Summer Research Symposium" (2014) and collectively as an undergraduate research group at the "Carnegie Mellon University Meeting of the Minds Conference" (2015) [1, 2]. Within this time frame, our small group of undergraduate students successfully synthesized and oligomerized four out of the six monomers that are needed to develop our antibiotic.

Due to the extensive, analytical nature of our project and my interests in working and learning in another culture I applied for and attained a summer research scholarship in Kiel, Schleswig-Holstein, Germany to develop the relevant skills to further our enquiry. The program was called the DAAD Rise Summer Research Internship Scholarship and I worked at the Christiana Albertina University of Kiel with the Frank

Sönnichsen group. In conjunction, I was awarded a Carnegie Mellon University Tartans Abroad and a Carnegie Institute of Technology Travel Grants to fund my travelling. The Protein engineering project was focused on, "Observing the stabilizing effects of the Tryptophan-Cage (Trp-Cage) Protein on the Amoebapore A -Helix II". The motivation of the project was to observe the efficacy of a chimera approach to stabilizing the Amoebapore A -Helix II protein so that one day an antimicrobial drug could be developed. During this research I developed advanced skills in ^{1}H-NMR, 2-Dimensional NMR (NOESY, TOCSY, ROSY, and HSQC), Solid Phase Peptide Synthesis and ion-spray (LC/MS) mass spectrometry. This experience also gave me the opportunity to present my data at the international conference, "2015 RISE Heidelberg Meeting", at the Heidelberg University in Heidelberg, Germany[3]. This gave me the experience of presenting complex research in a professional manner and facilitated skills of collaboration and flexibility in the research workspace.

The past three years of my college career has honed my skills of responsibility and academic stamina, an attribute that is necessary for a graduate's career at **Institution Name**. For the past two years of my college career I have worked as a residential assistant, which has responsibilities lasting over 20 hours a week. Due to my determination to do research I decided to incorporate my laboratory duties into my academic schedule, which in total took over 18 hours per week. I therefore learnt how to manage my time as a student, residential administrator, peer advisor, liaison between residents and the student life offices, and as a budding scientist perfecting my research skills. By planning science and engineering events I learnt how to engage students involved in STEM, a skill that I see useful in the future. I was therefore very pleased in acquiring recognition of my hard work by my inauguration into the engineering honor society Tau Beta Pi. This gave me the satisfaction of knowing that my high work ethic was bringing me a step closer to success. In essence, I know that I have the skills and stamina to produce great works under the academic vigor of this top institution, **Institution Name**.

References

1. **Simpson A**. RTD-1M: Modifications to the Backbone by Introducing Hydrophobic Side Chains Derived from Existing Glycolipopetide Antibiotics. Poster session presented at: Mellon Institute HHMI Symposium. 2014 August 7; Pittsburgh Pa.
2. **Simpson A**, Atwood J, Long K, Harwitz E, Mao C. Development Broad-Spectrum Antibiotics. Poster session presented at: Carnegie Mellon University Meeting of the Minds. 2015 May 6; Pittsburgh Pa.
3. **Simpson A**. Observing the Stabilizing effects of the Trp-Cage mini-protein on the Amoebapore A -HII protein sequence. Conference presented at: RISE Heidelberg Meeting; 4 July 2015; Heidelberg, Germany.

Part 2 - Statement of Purpose

Institution Name
Adam Simpson
Statement of Purpose

Within my graduate career I hope to develop a research plan that will positively impact both the US and Jamaica. I will do this by developing natural water treatment systems, in the US and Jamaica, and incorporating the works of ReNUWIt as an engineering research center allowing me to work with affiliated **Institution Name** faculty such as Professor A, Professor B and Professor C. My interests in environmental engineering were primed in the works of my parents well drilling company and the recent increases in NO_3^- within both US and Jamaican water supplies caused from agricultural runoff and wastewater effluents. This issue is particularly prominent in urban areas of both the US and Jamaica, hence it has become the object of my research interests.

There are pending stricter regulations on nutrient discharges in water. Furthermore, effluent sourced from wastewater treatment plants and agricultural runoff has resulted in the increase of NO_3^- pollution[1]. Traditional removal by ion-exchange systems requires large energy costs and replenishment of synthetic substrates with the added barrier of increased green house gas emmisions[2]. A viable alternative is engineered water treatment wetlands. Successful vegetated systems are increasingly being installed in temperate regions of the US in states including Florida, Texas, California and North Carolina[2, 3]. Furthermore, wetlands with residence times of 3-6 days are believed to be as effective as ion-exchange systems, with little to no energy consumption and ancillary benefits for habitat and recreation[1]. Despite wetlands growing usage for large-scale water treatment systems, there remain multiple issues concerning denitrification seasonality, predictability and modelling[1].

Recent research shows that shallow wetlands that incorporate geotextile fabrics facilitate denitrification rates that exceed those of more traditional vegetated systems while enabling photolysis and biodegradation of water pollutants such as endocrine disruptors and pharmaceticals[3]. Though currently deployed as a 2-D liner in these shallow wetlands, my choice of research would focus on porous (0.7-0.9) polyethylene, polyurethane or polyester fibers with high surficial area (500-1500 m^2/m)[4] deployed as inert geotextile supports. The system will be designed such that peripheral and interior zones within the biomat may be removed for biochemical and microbiological inquiry of the biofilm matrix[5] that forms within these natural systems. The incorporation of the physical properties of geotextiles to facilitate microbial growth and enhanced hydrologic flowpaths in combination with more traditional wetland structural features will enable both effective treatment and its utilization as a system intervention tool for denitrification mechanistic studies.

Apart from my research interests, after obtaining my PhD centered on denitrifying water treatment wetlands, I hope to develop an engineering consortium between engineers in the US and Jamaica. The goal of this is to adapt these low cost and low energy demanding, naturally inspired water treatment systems to the nation that is beginning to have increased prevalence of NO_3^- pollution caused by improper agricultural runoff practices and solid waste treatment. By opening this research consortium I hope to

develop satellite projects in Jamaica, which will both advance the broader impacts of researchers in the US, as well as harness better and more affordable environmental practices in Jamaica. The consortium could also target other industries such as ecotourism. For example, water treatment wetlands are known to both purify water, provide recreational and aesthetic pleasure, and habitat benefits. Furthermore, environmental researchers could investigate environmental processes within a region of a different geological and climatic makeup. This will encourage a developing volunteer community engagement via tourism and student centric projects through collaborations involving US universities.

Another career goal that I hope to accomplish is expanding the interests of STEM within students of K-12 by encouraging international projects where students can work for a summer on the research of denitrifying wetlands. I also want to encourage youths in Jamaica to develop interests in STEM, so they may too seek for an undergraduate education in the US. I believe an interesting way to assist this process is by making research open to high school students so they may get a glimpse of what it is like to ask learned questions and solve problems; monitoring wetlands is an ideal interface. Facilitating an open relationship between researchers in the US and Jamaica will solidify this development. This project will increase the international awareness of youths in the US. By introducing the works of STEM within the context of an international project and relationship, students of the US will hopefully be more drawn to these fields. This would undoubtedly make them try to find solutions to environmental problems, such as high water NO_3^- levels, and seek ways to impact the livelihood of the environment and people in their hometowns.

In general, graduate school is the first step I must take for a research career in Civil and Environmental Engineering. Continuing my education at **Institution Name** shows my need to improve upon my skills at an academically noteworthy institution and expand my research goals by working with ReNUWIt affiliated investigators such as Professor A, Professor B and Professor C. They will allow me to develop a strong basis of knowledge in natural water remediation systems and develop my research collaboration network. Along with a strong understanding in the field, **Institution Name** will have great opportunity to collaborate with many notable faculty members that will help me to advance in natural and sustainable water remediation research. I believe that **Institution Name** will make me well equipped to develop a robust research plan so that I may fulfill my career goals in creating an engineering consortium between engineers in the US and Jamaica. Having many of the worlds top minds and extensive research opportunities, I see **Institution Name** as the right fit for my research career in natural and sustainable water remediation systems.

References

1. Jasper, Jones, Sharp & Sedlak. Nitrate Removal In Shallow, Open-Water Treatment Wetlands. *Environ. Sci. Technol.* **2014**, 11512–11520.

2. Cunningham, Sharp, Hiebert & James. Subsurface Biofilm Barriers For the Containment and Remediation of Contaminated Groundwater. *Bioremediation Journal*. **2010** 151–164.

3. Jasper, Nguyen, Jones, Ismail, Sedlak, Sharp, Luthy, Horne & Nelson. Unit Process Wetlands For Removal of Trace Organic Contaminants and Pathogens …Wastewater Effluents. *Environ. Sci. Technol.* **2013**, *30*, 421–436..

4. Boelee, Janssen, Temmink, Shrestha, Buisman & Wijffels. Nutrient Removal And Biomass Production in an Outdoor Pilot-Scale Phototrophic Biofilm Reactor for Effluent Polishing. *Appl Biochem Biotechnol* **2013**, 405–422.

5. Flemming & Wingender. The Biofilm Matrix. *Nature Reviews Microbiology*. **2010**, *8*, 623–633.