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I am delighted to serve as the Collegiate Science Technology Entry Program (C-STEP) Director at the University at Albany.

There is a need for the world to produce more scientifically and technically trained individuals. The C-STEP program, funded by the New York State Department of Education, is one of the ways in which the University is providing support in cultivating the academic talents of underrepresented populations to help meet this need. Currently, the technical employment market is witnessing unprecedented growth. We want to encourage as many undergraduates as possible to be prepared for the available opportunities in industry and teaching.

The C-STEP is a comprehensive effort to encourage underrepresented students to pursue their interest in related science careers, as well as law. Our C-STEP includes the following services: supplemental academic advisement; personal counseling; career planning; financial planning and information; culturally enriching activities; peer mentoring; faculty mentoring; study skills workshops; instruction in pre-college math and science; individual tutoring; study group programming; professional and graduate school preparation; cultural, professional and educational field trips to local industries; and an extensive summer research experience for 18 students. Felicia Collins, University at Albany C-STEP Coordinator, regulates these services.

I am extremely pleased with the unique partnership opportunity of students, faculty and the Albany community in supporting the development of our C-STEP. It is this kind of commitment and cooperation which we need to assist us with our goals of producing more trained scientists, physicians, lawyers and educators. Our research placements are at diverse locations, including various departments at the University at Albany, Gen*NY*Sis Center for Excellence in Cancer Genomics, Pharmaceutical Research Institute, the New York State Health Department’s Wadsworth Center, and the Stratton Veterans Administration Medical Center.

I’d like to take this opportunity to thank the many faculty members who gave their time and expertise in order to provide our C-STEP program scholars with a research experience that will help them prepare for the rigors of graduate school.

Sincerely,

Dr. Christopher Fernando
C-STEP Director
It is my pleasure to present to you the Student Research Journal of the University at Albany Collegiate Science and Technology Entry Program. This journal is a tribute to our summer research scholars who along with their faculty mentors were engaged over an eight week period in scientific discovery. The students who are profiled participated in our program during the summer of 2009. The journal represents their scholarly endeavors, academic excellence, and future professional goals.

I congratulate our scholars on a job well done. They have performed with a sense of purpose and inquisitiveness. They are truly scholars. I also must thank the faculty mentors who have graciously dedicated their time and themselves to securing our future in the science, technology, engineering and mathematics fields.

In addition, I must acknowledge our C-STEP support staff and our University community of professionals, for without them this program would not be as successful.

Sincerely yours,

Felicia Collins
Coordinator
C-STEP, LSAMP, AGEP and
University at Albany Summer Research Program
Abstract
The fruit fly Drosophila melanogaster relies on an innate immune system to combat diseases and infections. This defense mechanism relies on several pathways, the major ones being the Toll pathway and the Imd pathway. These pathways act to produce antimicrobial peptides (AMPs) that provide protection against bacteria, fungi, and other microbes. In this study, we will inject different strains of bacteria sampled from Drosophila habitats into wild type flies (E23) and two mutant flies, E20 flies which lack the Imd pathway and RM7 flies which lack the toll pathway in order to determine how they cause pathology. This research will allow us to better understand the way the immune system mediates responses and other pathological outcomes.

Future Career Plans
To earn MD or MD/PHD and to become a pediatric surgeon. Eventually I hope to become a philanthropist, giving underprivileged kids a chance to succeed.
Abstract

Aggregation of Mutant W156X of the Human Gamma D-Crystallin Protein and its Implications for Cataract

Cataract is one in a number of diseases that is attributed to the aggregation of proteins that are normally highly soluble. The goal of my research is to understand the physical and chemical properties of protein mutation W156X of the Human Gamma D-Crystallin (HGD) protein and its implication for cataract. Mutant protein W156X is the result of a nonsense mutation that causes 18 amino acid residues to be deleted from the C-terminus of the Gamma D-Crystallin protein. The deletion of these residues causes the exposure of several residues that are buried in the wild type HGD protein. Of the exposed residues: Leu112, Ile121, Val132, Tyr134, Glu135 and Leu136 all but Tyrosine and Glutamic Acid are hydrophobic. We believe that it is this exposed hydrophobic cleft of mutant W156X that causes the protein to aggregate and cause the light scattering and opacity observed in this cataract.

Future Plans
After graduation I will be taking a year off to travel abroad. The following year I plan to attending Medical School and eventually pursue a career in plastic surgery.
Abstract

Angiogenesis, which is the formation of new networks of blood vessels, is an important mechanism in organism. A fetus uses this system to form capillaries, arteries, and veins. Although it is an essential mechanism angiogenesis the amount of new blood vessel formation must be kept in balance. Cancerous cells use angiogenesis to grow and metastasize, taking nutrients and oxygen from the host organism. In this research an in-vivo experiment was conducted using Molecular Weight Heparin, Non Anti-coagulant Heparin and XT199 to inhibit angiogenesis in a pancreatic cell line: MPANC 96-luc. The Chick Chorioallantoic Membrane (CAM Assay) model was used for the in-vivo studies. The IVIS imaging system, an advanced single-view 3d optical imaging system designed to improve quantitative outcomes in vivo imaging was also used.

Future Career Plan

I have always wanted to pursue an MD but this summer's internship has opened my eyes to research. I am thinking of an MD/PhD after acquiring my BS in Biology. I am hoping to work with a group like “Doctors without Borders”; travel to developing countries (especially in Africa) to provide people with medical aid.

Illorna Abena Brew

Hometown Bronx, NY
Major Biology
Date of Graduation May 2010
Institution University at Albany
Mentor Dr. Shaker A. Mousa
Abstract
The use of peptide aptamers against medically-important disease targets
Peptide aptamers are molecules that bind specifically to a target protein and interfere with that protein's function. Identifying the peptide aptamers that bind to a specific target aids in the discovery of pharmaceutical drugs. These drugs ultimately can help treat complex disorders which arise in disease like diabetes. In order to select the peptide aptamers we followed the protocols of the yeast two-hybrid system. We will ultimately obtain the DNA's sequences of those peptide aptamers which bind to the desired target sites.

Future Career Goals
I am currently pursuing a Bachelor of Science degree in Biology. I plan on attending medical school in an MD/MPH program
Izuchukwu Kenneth Ibe

Hometown Owerri, Nigeria
Major Biology
Date of Graduation May, 2009
Institution University at Albany
Mentor Dr. Nilesh Banavali

Abstract
Structural and energetic analysis of functional nucleic acid distortions.

Nucleic acids are vital in the replication, transcription and translation of genetic information in all life forms. They can occur both in single stranded and double stranded forms with each strand composed of either DNA or RNA nucleotide polymers. Their double helical forms can therefore be either DNA duplexes, RNA duplexes, or hybrid DNA:RNA duplexes. Specific distortions of these nucleic acid strands play an important role in their biological functions. The present study will analyze these distortions at the single base pair level within nucleic acid crystal structures deposited in the RCSB Protein Data Bank. The relationship between these single base pair distortions and the corresponding duplex forms will be characterized. The energetic cost of these distortions will also be analyzed with an empirical molecular mechanics energy function using the CHARMM program. The results of the present study are expected to clarify the geometric and energetic aspects of the dynamic conformational changes involved in nucleic acid function at the single nucleotide resolution.

Future Career Plans
Pursuing a Medical Degree.
DNA damage can result from exposure to toxicants, ionizing radiation, and metabolic stress to promote cellular damage. Cellular systems have evolved different mechanisms for DNA repair and for eliminating damaged macromolecules. Autophagy is a cell-signaling pathway used by the cell to repair itself by removing damaged organelles and macromolecules. In this study we have used methyl methanesulfonate and Bleomycin as a DNA damaging agents to understand the role of autophagy in cell survival after DNA damage. We have used wild type *Saccharomyces cerevisiae* and six autophagy mutants (atg2, 5, 8, 9, 12, 14Δ) to study cell viability in the presence of MMS and Bleomycin with Rapamycin. The results of our experiment demonstrated that autophagy compromised mutants are more sensitive to DNA damage in the presence of Rapamycin. Our findings suggest that autophagy is an important cellular event in the prevention of carcinogenesis.

**Future Career Plans**
I would like to earn an M.D./PhD degree and open up a clinic in an underserved community in which patients could receive both medical attention and counseling.
Abstract

Angiogenesis is a process that affects cancer cells, causing tumors to grow at a rapid rate. Certain prescription drugs including Taxol(Palcitaxel) and Taxotere(Docetaxel) are used to help fight cancer by preventing angiogenesis. The goal of this experiment is to test the effect of 3 prescriptions drugs XT-199, Low Molecular Weight Heparin(LMWH) and Non-Anticoagulant Heparin(NACH) in slowing down Kaposi’s Sarcoma, a cancer caused by human herpes virus 8. Using MTT Cell Proliferation Assay, different concentrations of XT-199, LMWH and NACH will be tested. These results will be compared with those from previous studies done with other prescription drugs.

Future Career Plans
I plan to attend dental school. I also would like to further my career by going to the Orthodontic school of my choice.
Abstract
The role of Vitamin D in Breast Cancer:
The effects of radiation on vitamin d in normal mammary cells.

Vitamin D is now being linked to the potential prevention and treatment of breast cancer. The chemical \textit{7-dehydrocholesterol} is found in the skin and when exposed to sunlight it is converted to cholecalciferol or vitamin D3. In the liver, Vitamin D3 is hydroxylated, forming 25 hydroxycholecalciferol. Finally, in the kidney, it is hydroxylated once more, producing the active form of Vitamin D3, 1, 25-dihydroxycholecalciferol. When the active form of Vitamin D3 binds to its nuclear receptor VDR, certain biological effects take place which influences cell proliferation, differentiation and apoptosis. In this study, we are exploring the potential for Vitamin D to prevent cancer cell growth. Human mammary cells pre-treated with Vitamin D, will be damaged with radiation and the results will be compared with normal mammary cells that were not pretreated with vitamin D, in order to determine if there is difference in cell survival.

Future Career Plans
My future career plans are to pursue an MD/PhD or an MD with emphasis on research. I also plan to pursue a career as a cytotechnologist before attending medical school. I am also keeping my options open considering careers such as Dentistry and Pharmacy.
When exposed to lead, *Saccharomyces cerevisiae* knockout strains, (mutants) *sam1Δ* and *met16Δ*, differ from the wildtype, BY4741, in phenotype. Strains with the *sam1Δ* and *met16Δ* mutations turn black and white color, respectively, compared to the light brown color of wild-type. The color correlates with activity of the sulfate metabolic pathway in producing sulfide. SAM1 catalyzes a reaction below sulfide. We hypothesize that loss of this gene increases cellular sulfide levels which makes the strain resistant to lead. MET16, however, catalyzes the production of sulfide. We hypothesize that loss of MET16 decreases cellular sulfide levels which makes the strain sensitive to lead. We also hypothesize that when lead enters the cell, it binds to sulfide to make lead sulfide. Although we suspect that this protects the cell from damage, it allows high levels of lead to accumulate in the cell. Mutant strains *sod1Δ*, *dal81Δ*, *cox7Δ*, *cst1Δ*, and *pdc1Δ* are not in the assimilation pathway, however, they are effecting the pathway in some way.

**Future Career Plans**
Graduate from the University at Albany with a Bachelor Degree in Human Biology with a minor in music. It is my plan to attend optometry school and perhaps pursue a career in the area of research there as well. I will also like to pursue my passion for music and incorporate it into my career.
The Implications of Traumatic Brain Injury on OEF and OIF veterans

Traumatic Brain Injury (TBI) is a form of brain damage which results from sudden trauma to the brain. The symptoms associated with TBI vary in severity depending on the extent to which the brain has been damaged. Currently the CDC estimates that 5.3 million Americans, with TBI, need long-term or lifelong assistance to perform various daily activities. Traditionally the majority of TBI cases have resulted from falls, motor-vehicle accidents or assaults. Interestingly, in the past few years a high number of OEF and OIF veterans have been diagnosed with TBI. These groups of veterans are in a unique because they are amongst the first to be exposed to an extreme amount of blasts and shock waves. For example, as depicted in the media, these veterans are often the victim of roadside bombs. In order to gain a better understanding of how this form of TBI affects OEF and OIF veterans, a self-report study took place. Over a period of 3 years, 5 governmental facilities will monitor a sample size of 500 veterans. The results of this study have significant implications on the future of medicine due to the fact that it provides clinicians and administrators with information regarding the unique needs of OEF and OIF veterans. Additionally these results will aid researchers and clinicians to pin-point symptoms associated with this new form of TBI. In order to obtain this data, several aspects of each participant’s life were evaluated. First, the participants were asked to describe any symptoms that they attributed to the war. This data was collected for both the participants with TBI and those that were asymptomatic. Additional data was collected regarding the participants’ social and personal activities. The examined patients will be monitored over a time-period of two years in order to determine any symptomatic changes and cognitive deficits. As a result of this study, researchers hope to glean a more comprehensive idea of the symptoms associated with blasts injuries and exposure to shock waves. This knowledge will allow clinicians to appropriately assess and categorize these veterans; thus enabling them to be provided with the best possible care.

Future Career Plans
Persue a Medical Degree
Proteins are polypeptides with a unique amino acid sequence. Proteins are the active players in most cell processes, implementing the myriad tasks that are directed by the information encoded in genomic DNA. Organisms have different proteins each of which has different functions. The purpose of this research is to understand the functions of proteins using bioinformatics. Three different criteria will be used to identify protein function; protein localization, protein domain structure and protein three-dimensional structure.

Future Career Plans
Become a medical scientist and work for the National Cancer Institute. In addition my ultimate goal is to win a Nobel Prize.
Abstract

The Synthesis of Fluorinated Amino Acids Using Pentafluorosulfanyl Aldehydes.

An oxazocolone intermediate was formed by the self-condensation of hippuric acid in acetic anhydride. Using this intermediate, we will try to form azlactone using pentafluorosulfanylaldehyde. Azlactone will undergo alcoholysis to give dehydroamino acid ester, and will then be hydrogenated over palladium/carbon followed by hydrolysis to give 4-(pentafluorosulfanyl) leucine. Fluorinated amino acids have been increasingly studied for their uses in drug design especially in areas such as the nervous system and anticancer agents, and with the development of 4- (pentafluorosulfanyl) leucine we hope to open more doors for the synthesis of newer, better drugs.

Future Career Plans

I want to continue my research at the University at Albany, and one day I hope to pursue an MD/PhD program at a top medical school.
Abstract

The recent advancement of nanotechnology particularly in cancer treatment might have a profound impact in the near future. Relatively lower toxicity, side effects, site specificity and tenability of the nanoparticle carrier system has the potential to change the current scenario of cancer treatment. Nanoparticle carrier system made up of biodegradable polymer like Poly (lactic-co- glycolic acid) has significant advantages for their long safety history, biocompatibility and their unique property to control the rate of polymer degradation and drug release. In this study, we will report the synthesis of an optimum nanoparticle formulation using different PLGA polymer with different ratios of lactic acid and glycolic acid. The optimized formulation will be used to co-encapsulate Paclitaxel and NapSul – ile –Trp-CHO both known to be anticancer drugs. Also the loading efficiency of Paclitaxel and NapSul – ile –Trp-CHO will be optimized. Finally the in vitro efficiency of this formulation will be tested in breast cancer cell line like MDA-MB-231, MCF – 7 and MCF-7R (doxorubicin resistant).

Future Career Plans

Get a master’s degree in Biomedical Engineering. After getting my master’s degree, then applying to medical school and getting an MD/PhD, and finishing up my career by opening up my own clinic.
Abstract

Our laboratory has showed that the non-genomic effect of 3,5,3’-Triiodo-L-thyronine (T3) can be exploited by encapsulating this hormone in the polymeric matrix of Chitosan-PLGA (CHI-PLGA) nanoparticles. T3 encapsulated CHI-PLGA nanoparticles, have the potential to be used as a possible treatment for gangrene, limb ischemia and to coat medical devices in order to increase their biocompatibility. This study will report the synthesis of an optimal formulation of CHI-PLGA nanoparticles encapsulating T3 and labeled with cy3/Alexa fluor 488. Side by side free T3 will also be labeled with the same dye. The uptake of these cy3 labeled free T3 and cy3 labeled CHI-PLGA nanoparticles encapsulating T3 will be examined in human endothelial cells such as Human Umbilical Vein Endothelial cells (HUVEC) and Human Dermal Microvascular Endothelial cells (HDMEC) at different time intervals using confocal microscopy.

Future Career Plans

Karen is pursuing a M.D.-Ph.D. degree in order to become a medical scientist. After finishing her studies, she plans on conducting clinical research, hoping to translate scientific research into medical advances.
The purpose of this research was to investigate the effects of XT199 (αvβ3 integrin antagonist) on the expression of SIRT1 in three breast cancer cell lines, MDA-MB-231 MCF-7, and MCF-7/DOXR. Sirtuin 1, also known as silent mating type information regulation 2 homolog S. cerevisiae, is an enzyme that deacetylates proteins that contribute to cellular regulation. Because this reaction affects stressors and longevity, gene SIRT1 has been implicated in lifespan determination and metabolism. By using Western Blot and RT-PCR, we can detect levels of the αvβ3 integrin, SIRT1 and mRNA of SIRT1 in different cancer cell lines samples that treated with different concentrations of XT199.

**Future Career Plans**
After graduation, I plan to attend medical school. As a doctor I hope to work with underserved populations in the United States or abroad.
MISSION STATEMENT

To expand the horizons of the mind in science, technology, and other Ph.D. fields through research and scholarly activities.