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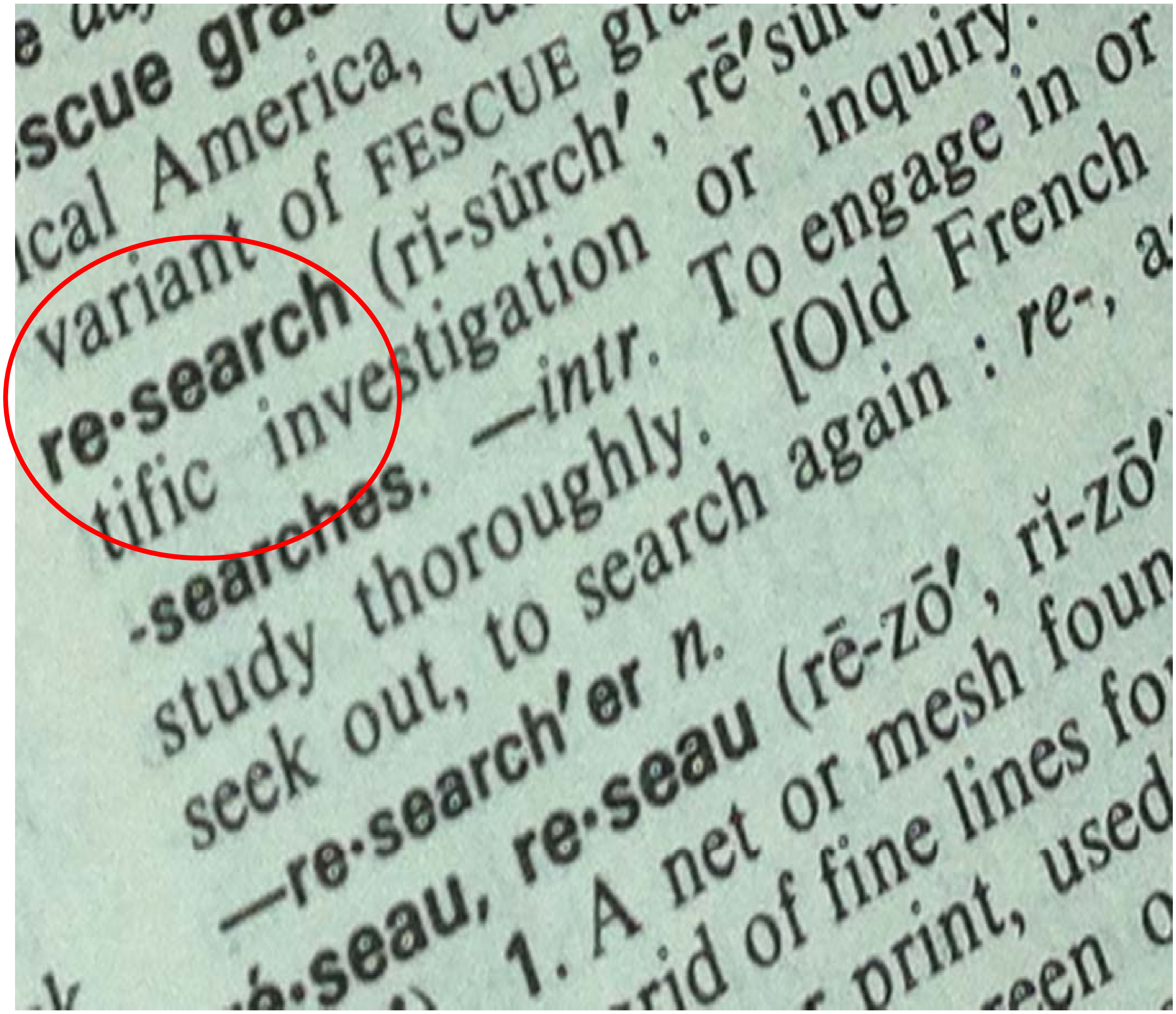

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A Closer Look at COST Research Centers

NSF Supported Center of Research Excellence in Science and Technology at TSU

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Description of the Center

The "Center for Research on Complex Networks (CRCN)" is a newly awarded NSF Center of Research Excellence in Science and Technology (CREST) worth a total $5 million dollars to be awarded over next five years. The Center's multidisciplinary team, led by Drs. Wei Wayne Li (PI), Lei Yu (Co-PI) and C. J. Tymczak (Co-PI), as well as Drs. Oscar Criner (Director of Education) and David Olowokere (Director of Technology Transfer), comprises a total of 14 faculty scholars representing 6 different departments in the College of Science and Technology (COST), including the Departments of Computer Science, Transportation Studies, Physics, Engineering Technology, Mathematics, and Chemistry (Fig.1). The Center will conduct research in complex networks, including: energy efficient wireless sensor networks (EEWSN), urban transportation environmental networks (UTEN), and distributed computational networks (DCN). This research will be integrated into COST's science, technology, engineering and mathematics (STEM) curriculum/educational programs.

The achievement of these goals will enable minority and under-represented students to pursue advanced graduate degrees, contributing to meeting the future critical workforce needs of the nation in STEM fields. The funded Center will have a tremendous impact on TSU students by providing financial support for a minimum of 20 graduate and undergraduate students each year during the next five years, while they work with TSU faculty on cutting-edge research. To achieve the mission and goals of the Center, we have identified three interdependent research subprojects in complex networks. The subprojects cover research in: (1) development of energy efficient wireless sensor networks, which will explore and develop novel wireless sensor networks, data aggregation protocols, and various wireless communication models and algorithms, (2) urban transportation environmental networks, which will discover and develop vehicle emission models and real-time intelligent network control methods to reduce greenhouse gas and pollutant emissions, thereby improving urban air quality, and (3) distributed computational networks, which will develop and implement algorithms for computing on networks for which the resource allocation is uneven.

The research activities in the three subprojects will be conducted in parallel, in a interrelated manner involving the disciplines of computer science (Drs. Li, Criner, Sleem, Khan), transportation (Drs. Yu, Qiao, and Qi), physics (Drs. Tymczak, Vrinceanu), engineering technology (Drs. Olowokere, Chen, and Zhang), mathematics (Dr. Chilakamarri), and chemistry (Dr. Wei). The participants of the Center consist of both young and experienced researchers, engineers, physicists, chemists, mathematicians, and transportation scientists at TSU. The aforementioned participants form an interdisciplinary cadre of expert scientists and engineers that can perform cutting edge research of complex networks in wireless, computational, and urban areas and that can implement educational, outreach, and mentoring initiatives in order to advance TSU's goal of becoming a leader in science and technology.

Impact on COST

The goals of the education program in this Center are to: (1) increase the constituent pool of secondary school students willing to study STEM subjects, (2) increase the numbers of African American, Hispanic, and other minority students who choose to study STEM subjects, (3) enhance the educational achievements and research experiences of participating undergraduate and graduate students, and (4) significantly increase the numbers of students undertaking doctoral level study in STEM fields.

The research experiences for undergraduates and graduate students component is designed to allow students to participate in research each year under the guidance of faculty members. Students will be required to perform research, provide a formal seminar on his/her work, and write a final report. The level of graduate research will be more involved and detailed than for undergraduates. However, participation by both in a large project will develop their teamwork skills necessary in the professional workplace. For example, environmental science students are currently monitoring a network of sensors for volatile organic compounds in the Houston area. There are many research questions that need to be addressed in this area. One such area is the pollution caused by the transportation system. The urban transportation environmental network is addressing a complex environmental problem to which students will devote considerable attention.

Students will gain hands-on experience in the remote accessible wireless sensor network (WSN) laboratory and will learn how to design and program wireless sensor nodes and use them to monitor environmental phenomena. Workshops will be held on wireless sensor network and distributed computational networks that examine the development of real applications in the environment and. Students will also be exposed to the most current methods for managing and utilizing high performance computing for transmitting, collecting, and analyzing data from WSNs. Students will be exposed to the latest techniques for measuring and monitoring environmental phenomena. We envision over 20 graduate and undergraduate students per year will be recruited and supported by the Center over five years. The mission of this NSF Research Center is to conduct innovative and multidisciplinary research in the area of complex networks; doing so will provide a knowledge base for understanding complex networks including: energy efficient wireless sensor networks, urban transportation environmental networks, and distributed computational networks. Furthermore this Center will catalyze development and implementation of policies for global environmental sustainability. Research carried out by the Center will be integrated within the STEM educational programs in the College of Science and Technology (COST), particularly striving to expand the pool of underrepresented minority students pursuing advanced graduate studies in STEM fields.

Achieving the aforementioned, will allow the Center, COST, and TSU to meet the critical STEM workforce shortage in our nation. The Center will also promote and implement diversity in STEM disciplines through educational outreach initiatives and extensive effort to recruit, retain, and train members of underrepresented minority groups. The attempt is to prepare minority students for leadership positions in the fast-changing, global scientific, engineering, and government sectors. This is in line with our College's mission, "The College is dedicated to integrating sciences and contemporary technologies, through education, scholarly activities, and community service; meeting the needs of a diverse graduate and undergraduate student population while addressing critical urban issues within a global economy."

Figure 1. CREST Research team. Co -PI Lei Yu left front. PI Wei Wayne Li top left. Co-PI CJ Tymczak bottom right. Photo courtesy of Hector Miranda.

A Closer Look at COST Research Centers

The Center for Transportation Training and Research
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Description of the Center

The Center for Transportation Training and Research (CTTR) is a transportation research component of Texas Southern University (TSU). As a companion to the Department of Transportation Studies, the CTTR is dedicated to conducting research on current transportation-related issues. CTTR conducts research and training in conjunction with the Southwest Region University Transportation Center (SWUTC), a consortium that consists of Texas A&M University, Texas Southern University, University of Texas at Austin, Louisiana State University, and the University of New Orleans. In addition, CTTR Director and Associate Professor of Transportation Studies, Dr. Carol Abel Lewis, conducts collaborative research focusing on evacuation modeling during hurricanes within TSU, with the Severe Storm Prediction, Education and Evacuation from Disasters (SSPEED) Center at Rice University, and with the Center for the Study of Natural Disasters, Coastal Infrastructure and Emergency Management (DIEM) Center of Excellence at University of North Carolina.

CTTR conducts basic and applied research to solve problems and identify options for the improvement of mobility. CTTR supports the academic curriculum through employment and training opportunities in research and demonstration projects for students in transportation, computer science, and urban planning and environmental policy.

Faculty and students identify problems and solutions to a variety of issues facing our society by applying state-of-the-art techniques and research methodologies. These issues include transportation security, Intelligent Transportation Systems (ITS), operation of intermodal systems, alternative fuel comparison studies, suburban employment growth/transit accessibility issues, policy, planning, and human resource management. CTTR maintains a creative research agenda, providing an environment to explore relevant research that encourages critical thinking and develops industry partnerships.

Texas Southern University is a co-leader in the National Transportation Security Center of Excellence-Petrochemical (NTSCOE-P) whose role is to investigate and advance methods and strategies that will increase the resilience of the nation's multimodal infrastructure to terrorist attacks on the movement of petrochemicals. This center of excellence is coordinated through CTTR. NTSCOE-P is delivering products in a phased strategy through a multi-year approach. The related research focuses on the issues related to commodity flow, vulnerability assessment, and impact analysis involved in the design of a more secured transportation system for transporting petrochemicals. The core of the research develops models and tools that can be readily used for recurring analysis and assessment of multiple scenarios applied to petrochemical transportation security. One product, Petrochemical Incident Location System (PILS), provides a historical perspective of hazardous material incidents throughout the United States.

CTTR's research program is structured to provide modally-balanced outcomes that advance the state of the industry in transit, highway, and national security. The products of this research promote a transportation that is sustainable in terms of the level and quality of transportation services, the resources commanded, the environment affected, and the quality of life supported. We are committed to this mission, which improves our communities and prepares the next generation of transportation professionals.

Impact on COST

Graduate students conduct research and have presented nationally on current transportation issues including: 1)*Analysis of Hazardous Materials in the Gulf Coast Region*: *A Case Study of Houston, TX (Latissha Clark*), 2) *Identification of Gaps in the Unauthorized Petrochemical Release Reporting Structure (Shain Eversley)*,3) *Evaluating the Texas Triangle Megaregion and Its effect on Airport and*

Airspace Capacity (Sara Land), and 4) *The application of Traffic Software: Assessing Effectiveness of Bus Rapid Transit in Addressing Congestion in a Freeway Corridor (Sascha Sabaroche)*. Gwendolyn Goodwin, CTTR staff and Eisenhower Fellow, presented at the International Conference on Transport and Mobility for Elderly and Disabled People **(**TRANSED) in China - *DRIVING CESSATION: WHO GIVES YOU THE RIGHT TO DECIDE?* She was also the Eisenhower presenter at the 2011 Transportation Research Board (TRB) in Washington DC presenting: *The Impact of Driver licensing regulations and Crashes and Fatalities for Seniors in Texas (Fig. 1)*.

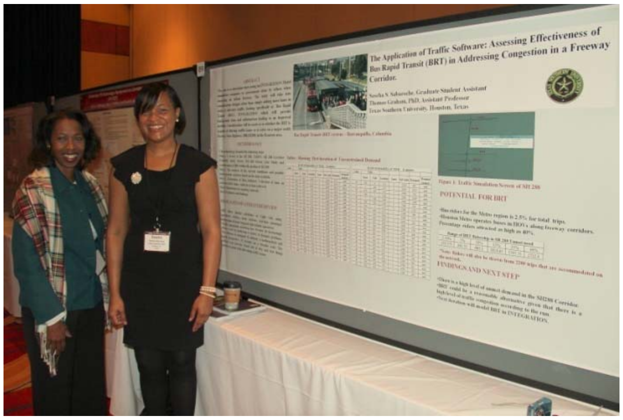

Figure 1. Photo of Sascha Sabaroche (right) and Dr. Carol Abel Lewis (left) at Transportation Research Board (TRB) meting in Washington, DC in January, 2012. Photo courtesy of Dr. Lewis

Also, CTTR serves as an independent host site for the National Summer Transportation Institute (NSTI) in Houston and its surrounding areas, under the leadership of Mr. Khosro Godazi, Associate Director of CTTR. NSTI is an educational experience that began in 2001 and exposes high school students to all modes of the transportation industry via hands-on technical activities, field trips to transportation facilities, lectures by transportation professionals, and on-site seminars, lectures, and academic enhancement exercises. The on-campus four-week session is designed to encourage a diverse cadre of motivated secondary school students to pursu transportation careers and to address the need for a well-trained, qualified, diverse workforce in the 21st century. The NSTI is one of several educational initiatives of the Department of Transportation challenging the country to work with youth of all ages and help them focus on skills in math, science, and technology. The CTTR is located in the 4th largest city in United States, Houston, Texas (Fig. 2 and 3), and, as such, will play a vital role in the transportation landscape of the city's future.

Figure 2. Houston, Texas. Photo courtesy of Shishir Shishodia.

Figure 3. Houston, Texas. Photo of Houston Buffalo Bayou Greenway. Photo courtesy of Shishir Shishodia.

Cell Signaling and Cancer Biology

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Dr. Shishir Shishodia, Ph.D., is an Associate Professor with 7 years of service in the COST Department of Biology. In 1993 and 1997 he earned his M.S. and Ph.D. degrees from Banaras Hindu University in India (respectively) before moving to Texas where he began his postdoctoral training at MD Anderson Cancer Center.

Shishodia joined TSU in 2005 and quickly established his research program within the department, focused on the identification of novel “blockers” of nuclear transcription factors derived from plant sources. Furthermore, his group aspires to determine phytochemcial anti-tumor, chemopreventive, and chemotherapeutic potentials both *in vitro* and *in vivo.* Ultimately, the lab’s goal is to investigate the mechanism of action of these phytochemicals.

The pro-inflammatory transcription factor, nuclear factor (NF)-κB is an inducible and ubiquitously expressed transcription factor for genes involved in cell survival, cell adhesion, inflammation, differentiation, and cell growth. Genes regulated by NF-κB have been shown to suppress the apoptotic cell death program and induce inflammation, proliferation, invasion, angiogenesis, and tumor metastasis. NF-κB is activated by a variety of stress stimuli, carcinogens, and tumor promoters including: oxidative stress, inflammation, radiation, microgravity, bacterial lipopolysaccharides, and cigarette smoke [1-6].

The focus of Dr. Shishodia’s research has been testing whether agents that suppress NF-κB activation have the potential as being effective therapeutics for treatment of various inflammatory diseases, including some cancers. Novel phytochemicals like ursolic acid (from rosemary, apples, prunes, and plums), curcumin (diferuloylmethane from rhizome of curcuma longa), diosgenin (from fenugreek), and guggulsterone (from gum guggul) have all demonstrated potential chemopreventitive functions [2-6].

Most of these agents in their crude form are used in traditional medicine. However, unlike the rationally designed modern drugs, the plant-derived dietary agents are affordable, effective, and have no known side effects. Establishing a clear rationale to support these dietary agents through utilization of modern scientific approaches will empower the population at risk and the medical community with the requisite knowledge necessary for correctly using a specific natural product.

In another study, the cell signaling laboratory is involved in investigating the effects of modeled microgravity changes and space like radiation in vitro and in vivo. We will identify biomarkers of stress factors and develop countermeasures to the stress effects to enable long-term, human presence in space without incurring unacceptable health risks due to unavoidable exposure to ionizing space radiation [1].

This laboratory is actively involved in student training who are an integral part of our research team. The laboratory has graduated 4 MS students and 12 undergraduate students. At present 2 graduate students and 2 undergraduate students are working with on the research projects. The laboratory also hosts college students during summer through the Ronald McNair Research Institute.

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Dr. Shishodia (left) standing with undergraduate and graduate research students in his research lab. Photo courtesy Shishir Shishodia

Dr. Shishodia (left) standing with collaborator Dr. Jim Briggs (UH—right) at Johnson Space Center during the launch of their NASA URC Microbial 1 mission on board the STS-129. Photo courtesy Shishir Shishodia.

Dr. Shishodia (left) providing mentorship to one of his graduate student trainees. Photo courtesy Shishir Shishodia.

Rydberg Atoms are Shaken in Distant Encounters with Slow Protons

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"*Since I am an atom as big as bacteria I've got to take microwaves serious. No matter what I do, I'll be cryin' … After they hit me, I'll be an ion*."

So begins a poem written in 1974 by Peter Koch (then at Yale) during the stresses of preparing his PhD thesis about highly excited atoms, often called Rydberg atoms, or "atoms in high Rydberg states." The unusual properties of these atoms (some of which have been prepared with principal quantum number as high as n=105) arise because of their large size and small ionization potential, as Koch's poem suggests.

The electron of a Rydberg hydrogen atom orbits the nucleus very much like a planet orbiting the sun (elliptically). Without affecting the atom's energy, the eccentricity of the orbit, measured by the angular momentum, spans a wide range of variation, from circular to very elongated shapes. This parameter is very important because it radically changes atomic properties. For example, a circular state persists for a much longer period than an elongated orbit in which the electron becomes "bruised" every time it approaches the nucleus too closely.

Regardless of how created, Rydberg atoms exist among other atoms or parts of atoms, such as protons, that collide, sometimes head-on, with the Rydberg atoms themselves. It is, therefore, natural to assume that the angular momentum is continually adjusted in such collisions. Surprisingly, however, a group of researchers at the Harvard-Smithsonian Center for Astrophysics, led by Dr. Vrinceanu of TSU, has discovered that even slow protons, coming toward a Rydberg atom, passing it at distances of 10 to 30 times the size of the atom, can produce significant changes in the angular momentum of the target Rydberg atom [1]. The key for understanding this puzzling and counterintuitive result is rooted in the fact that in such slow and distant collisions the angular momentum does not change suddenly as in a normal collision; instead, it occurs more gradually, accumulating its effect over many orbits. The electric field of the slow projectile induces an orbit precession of the Rydberg electron, from circular to elongated shapes, for example. As a result, the cross section for this process is enormous, reflecting the "action at a distance" characteristic of this phenomenon.

Rydberg atoms are customarily created in the lab by laser excitation, and they have been observed as constituents in various astrophysical objects. More importantly, however, it is believed that, during the evolution of the early Universe, electrical charges in the primordial plasma recombined to form neutral Rydberg atoms before normal, ground state atoms were formed. The radiation emitted during that stage forms a background radiation that persists to this day encoding crucial information about the early universe dynamics. This Cosmic Microwave Background is measured with extreme accuracy, and even more sensitive measurements will be available once the Planck Space Observatory becomes operational.

Many aspects concerning the collisions of Rydberg atoms with other particles have yet to be included in mathematical models and computer simulations of the formation of the early universe. This is, in part, due to a lack of reliable calculations for the rates of these atomic processes. In a search for agreement among increasingly precise observations, it is, therefore, crucial to have equally precise information about all atomic processes.

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Beam Me Up: A Trip to Alpha Centauri

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We have all watched Star Trek and other show of similar themes where the intrepid crew steps into their ultra high-tech space ship and zooms off across the Universe. But the question that can then be raised is, "How possible is this really?" The answer given by our current physics knowledge is, "….not very likely." For example, let us consider traveling to our closest neighbor, the star Alpha Centauri (Fig.1). Alpha Centauri is 4.24 light years from our solar system. This means that a beam of light will take 4.24 years to arrive at Alpha Centauri. Below, I show the time it would take to get to Alpha Centauri using our existing technology (Table 1).

Table I: Time to travel to Alpha Centauri

Vehicle	Speed (mph)	Time to Alpha Centauri (years)
Automobile	60	47 million
Space Shuttle	17,580	161,700
Saturn V Rocket	25,053	113,500
Voyager II Space Probe	43,396	65,500
Light Beam	670,616,629	4.24

Obviously, we will need to develop completely new technologies in order to travel to even our closest neighboring stars. What is needed is a more compact energy source then chemical energy could ever provide, such as nuclear energy or, alternatively, "antimatter" [1]. What is antimatter? Antimatter is the mirror image of matter (Fig. 2). For every particle in nature, there is a corresponding antiparticle. Antimatter is real and is made in particle accelerators across the world every day.

For example, recently CERN (Biggest particle accelerator in the world located in Switzerland) has succeeded in making and storing minute amounts of anti-hydrogen. When matter and antimatter meet, they annihilate in a burst of energy, serving as the ultimate energy source.

Let us consider three possible energy sources for our interstellar spacecraft: nuclear fission, nuclear fusion, and antimatter. All three energy sources convert a percentage of their mass into energy (the famous $E=mc^2$). For nuclear fission (e.g. Chernobyl) it is 0.1%, for nuclear fusion (e.g. H-bomb) it is 0.3%, and for antimatter it is 100%. Now, let us consider that the energy generated from these fuels is used to accelerate some "reaction mass" which propels the spacecraft forward through space (via conservation of energy and momentum). We will refer to the mass that is converted into energy as "energy mass" and, as just mentioned, we will refer to the mass used to push the spacecraft forward as "reaction mass". For demonstrative purpose, let us assume that these processes are 100% efficient. The Table below indicates the time it would take to get to Alpha Centauri using the three aforementioned fuels types in relation to the ratio of the rocket to the "energy mass", as well as the maximum velocity our hypothetical ship can attain.

As can be seen in Table II, the practical maximum that fission can give us, at best, is a travel time of 32 years, which approaches the realm of possible. Fusion, on the other hand, would allow us to get there in 16 years under optimal conditions. This is an improvement over fission but still remains quite a lengthy trip. However, antimatter is, by far, the best fuel which would allow us to reach our destination within 4.25 years. Furthermore, if one would factor in the time dilation, which a very strange effect that when an object approaches the speed of light, the object experiences time at a different rate (slower) then the "nonmoving" universe. Our intrepid Astronauts would only experience 4 months of travel time, thereby requiring only 4 months worth of supplies for the trip!

Obviously, if we plan on traveling to our nearest neighbors, we will need an anti-matter “energy source” (Fig. 3) to achieve our goal.

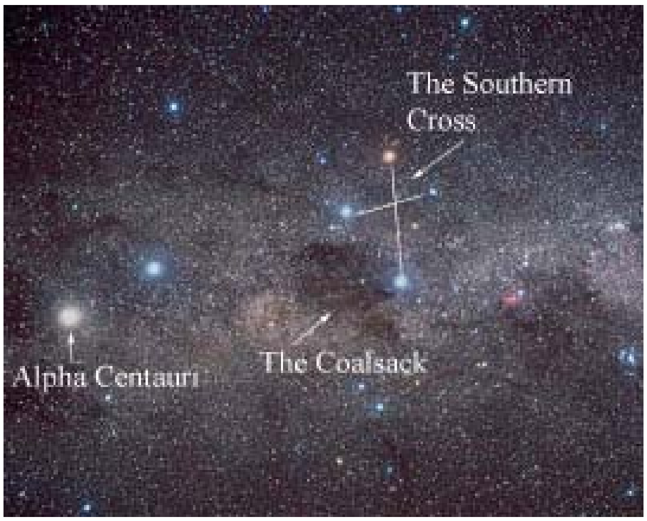

Figure 1. Our nearest star ,Alpha Centauri.

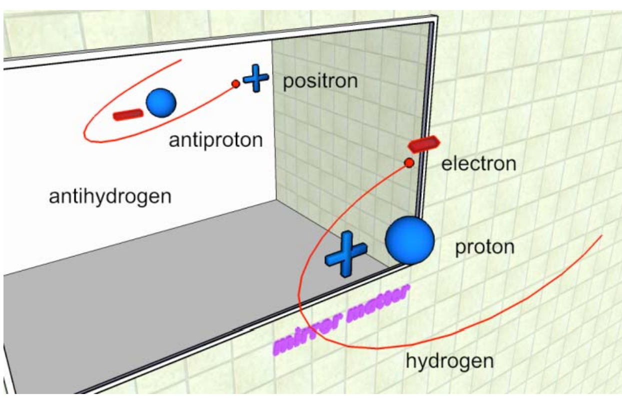

Figure 2. Antimatter. Mirror image of matter. Fig courtesy of Daniel Vrinceanu, Ph.D.

Table II: Time to travel to Alpha Centauri using Fission, Fusion and Antimatter

M_{fuel}/M_{rocket}	Fission		Fusion		Antimatter	
	V_{max}/c	Time	V_{max}/c	Time	V_{max}/c	Time
0.0156	0.0044	974.20	0.0087	484.79	0.1412	30.03
0.0313	0.0062	688.87	0.0124	342.81	0.1981	21.40
0.0625	0.0087	487.11	0.0175	242.41	0.2760	15.36
0.1250	0.0123	344.45	0.0247	171.43	0.3793	11.18
0.2500	0.0174	243.58	0.0350	121.25	0.5082	8.34
0.5000	0.0246	172.25	0.0494	85.78	0.6534	6.49
1.0000	0.0348	121.83	0.0698	60.71	0.7918	5.35
2.0000	0.0492	86.19	0.0986	43.01	0.8967	4.73
4.0000	0.0695	61.00	0.1389	30.53	0.9578	4.43
10.0000	0.1034	41.02	0.2053	20.65	0.9898	4.28
20.0000	0.1309	32.38	0.2585	16.40	0.9969	4.25

M_{fuel}/M_{rocket}: The ratio of the amount of Energy Fuel with respect to the mass of the rocket

V_{max}/c:The ration of the maximum speed the rocket will reach with respect to the speed of light

Time: The minimum time it would take to reach Alpha Centauri in years

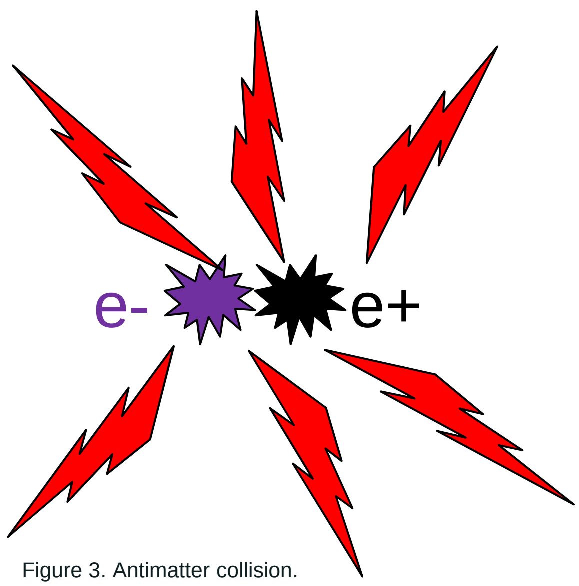

Figure 3. Antimatter collision.

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Internal and External COST Faculty Collaborations

Extending Research Capabilities Through Collaborators Yields Fruit

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Collaboration between Dr.'s Rosenzweig and Chopra

During the Fall of 2008, Dr. Rosenzweig was drawn to Dr. Ashok K. Chopra's research program on account of its vaccine development aimed at the plague bacterium, *Yersinia pestis,* on which Rosenzweig also happens to be an expert. Chopra is a full Professor of Microbiology and Immunology at the University of Texas Medical Branch (UTMB) in Galveston, Texas as well as the Director of the Sealy Center for Vaccine Development at UTMB. Chopra has biosafety level 2 labs as well as biosafety level 3 labs and animal facilities housed in the Galveston National Laboratory. Such facilities allow Rosenzweig to expand his cell-culture based studies to animal models of infection using more clinically relevant strains of *Y. pestis*.

Professional Development of Rosenzweig

Following 6-10 months of experimental planning regarding the use of several of Rosenzweig's *Y. pestis* mutant strains in animal infections, what followed was unprecedented productivity from their interactions. Between 2009 and 2011, Rosenzweig co-authored 4 peer-reviewed manuscripts in journals indexed on the premier search engine Pubmed [1-4].

Currently, productivity and the publishing pace remains torrid. In 2012, Rosenzweig and Chopra have an invited book chapter on the influences of space-flight and modeled microgravity on bacterial virulence recently accepted in Intech's Spaceflight ISBN 979-953-307-981-2 (due in print sometime in June). Also, Rosenzweig and Chopra just got a fifth manuscript accepted for publication in the peer-reviewed journal Expert Reviews Vaccines ISSN 1476-0584 (also due in print in June 2012). In addition to enhanced publications yield, Rosenzweig also benefited professionally through an invited seminar at the 10th International Symposium on *Aeromonas* and *Plesiomonas* in Galveston, Texas on May 19th-21st, 2011 (Fig. 1).

Fig. 1. Rosenzweig (left) delivering a research seminar at the 10th International Symposium on *Aeromonas*. Chopra (far right) watches closely. Photo courtesy of Ashok Chopra, Ph.D.

At the symposium, Rosenzweig delivered a research seminar entitled "*Aeromonas hydrophila, a possible model organism for low shear modeled microgravity (LSMMG) studies: Unexpected modulation of other enteric pathogens and Yersinia pestis virulence following exposure to LSMMG.*"

The prestigious opportunity allowed for important networking that continues to impact Rosenzweig's professional development.

Impact of Collaboration on TSU Students

The most direct student impact from the Rosenzweig-Chopra collaboration has been on Ph.D. candidate Abidat Lawal, an Environmental Toxicology student who has been working in the Rosenzweig lab since 2008. Exposure to resources and the research environment at UTMB has allowed Lawal to master animal infections, bacterial load studies, and host-cytokine profiling assays.

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The Application of Traffic Software: Assessing the Effectiveness of Bus Rapid Transit (BRT) in Addressing Congestion on a Freeway Corridor

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Introduction

According to Anthony Downs in his book, Still Stuck in Traffic [1], congestion cannot be eliminated. Such a strong viewpoint heightened this author's interest in determining ways in which congestion could be alleviated as well as identifying the factors which have increased congestion over the years. This area has become a topic of concern for many decades. Houston, Texas, suffers from traffic congestion and, as a result, seven of the eight freeways have High Occupancy Vehicle (HOV) lanes in order to accommodate greater volumes of traffic. Of Houston area freeways, only lack HOV lanes including State Highway 288 (SH 288), also called the South Freeway. It is noted that unique from other highways in Houston that are affected by the continuing congestion, SH 288 corridor has the potential to build a facility in the median. This work will explore the possibility of implementing Bus Rapid Transit (BRT) in that median.

Background

SH 288 is one of many highways that is accessible to a number of employment centers in Houston, including the Medical Center and Downtown Houston and links residential areas, businesses, and even large industrial and petrochemical facilities. SH 288 was formally opened September 5, 1984. The freeway itself is almost five miles long within the 610 Loop. It was designed to be an eight-lane freeway, leaving a wide median for a future inner freeway. Hence, this study will suggest developing that inner median into BRT system. Other uses for the median include a 2007 suggestion by Metro to build that portion of the freeway into one of the following three alternatives: 1.) enhanced bus service to connect commuters to Downtown Houston, the Texas Medical Center (TMC), uptown, and Greenway Plaza via general purpose lanes and on-street transit lanes on SH 288, 2.) enhanced bus service to connect commuters to Downtown Houston, TMC, Uptown, and Greenway Plaza via general purpose lanes and direct connector ramps between US 59 and SH 288, and 3.) A light rail transit or bus rapid transit connection to the existing METRORail Red Line at the TMC (This option would not necessary be in the freeway median).

Importance

The aim of this paper is to address the ever growing traffic congestion on SH 288 by contributing to the body of knowledge for decision making on how best to improve the freeway. This will also be beneficial when considering alternatives to simply adding more lanes in order to alleviate traffic by getting more people off the roads and into other modes of transportations, specifically a BRT system. Also, it will concentrate on considering whether the BRT is capable of altering traffic issues that exist on a major freeway (SH 288) in the Houston area.

Methodology

The methodology included a review of the SH 288 including evaluation of: TxDOT SH 288 Corridor Feasibility Study, Metro SH 288 Screen Line Study, and consideration of BRT within the median of SH 288. An analysis of the current conditions and possible future growth scenarios based on the data available was also included within the methodology as well as an evaluation of data collected relevant to traffic items and analysis of data retrieved. The methodology concluded with a simulation of a roadway network, along with the synthesis and findings.

Preliminary findings

Traffic simulation was done with the aid of INTEGRATION, a model which was chosen for this case study because it met the requirements to assess alleviating the traffic problems on SH 288. It was found that there is a high level of unmet demand in the SH288 Corridor. BRT could be a reasonable alternative given that there is a high level of traffic congestion according to the INTEGRATION run. Also, included is a potential for BRT where the bus riders for the metro region is 2.5 percent of total trips. Houston metro operates buses in HOVs along freeway corridors where the percentage of riders attracted was as high as 40 percent of total riders.

Houston, Texas Freeways. US 59 Southwest Freeway in Sugarland, Texas. Photo courtesy Shishir Shishodia.

Houston, Texas Freeways. I-10 Katy Freeway in Houston, Texas. Photo courtesy Shishir Shishodia.

Houston, Texas Park and Ride parking lot. I-10 Katy Freeway park and ride lot in Houston, Texas. Photo courtesy Shishir Shishodia.

Conclusion

In our research, we sought to analyze traffic volume and original distance data through traffic simulation software: INTEGRATION. This is done by using one of the most concentrated areas in Houston, Texas. Further, we sought to determine whether it was feasible to implement a BRT system in the median of State Highway 288 which was originally designed for additional lanes or mixed lanes of traffic and commuter mobility. Based on our results after using the basic concepts of traffic simulation software INTEGRATION, this project can offer guidance to government officials in their decision making processes.

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Student Driven Research in the COST

What a Worm Can Teach Us About Humans in Space

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Modeled Microgravity Research

Changes at the cellular, molecular, and organism level must be understood to prevent, reduce and/or reverse detrimental effects caused by reduced gravity on humans in space. *C. elegans* is a microscopic, free-living, non-parasitic worm and was the first multicelluar organism to have its whole genome sequenced. *C. elegans* provides an optimal system to understand the effects of environmental stress on biological systems. NASA has officially adopted *C. elegans* as a model organism to study the effects of space and space-like conditions and has flown *C. elegans* onboard shuttle missions in the past [1,2].

Currently, our laboratory has been examining aging, behavior, development, reproduction, and movement of *C. elegans* under simulated microgravity (SMG) which mimics a state of constant free- fall. To generate SMG, our lab uses a rotary cell culture system manufactured by Synthecon Inc., termed a high aspect ratio vessels (HARV) which are connected to a rotating base.

Single worms were examined for movement, esophageal pumps, reproduction, and aging. Worm movement and esophageal pumps were measured by counting the body bends every thirty seconds or by observing the esophagus. For reproduction studies, eggs were checked the following day for any hatching; if the any of the eggs hatched, worms would be observed daily.

Results

The final population of all life stages of the SMG-exposed *C. elegans* were reduced when compared to the normal gravity controls. Another observation was that SMG-exhibited a congested digestive system with unprocessed *E. coli* food supply. This has been a significant find in that SMG compromises the digestion of food and prevention of eliminating waste from the body. SMG-exposed mature adults exhibited hatched offspring within their bodies; offspring hatching inside of the dead hermaphrodites led us to conclude that the muscles of the valve had been hindered preventing the eggs to be laid.

It seemed that the reproductive system was less affected when exposed to SMG for shorter periods of time. Extracted eggs from cultures exposed to SMG for lengthier periods of time took a longer time to develop to the first larval stage and hatch. Longer exposure to SMG demonstrated lower reproduction and increased mortality. Some physiological changes were also observed. Thus far, our observation of *C. elegans* has provided useful data in the areas of SMG and reproduction.

Publications and meetings

Our resulting data is now being written up in two manuscripts that are currently in preparation. I have presented my research, at the 12th Research Centers in Minority Institutions International Symposium on Health Disparities in Nashville, TN. (December 2010), Texas Academy of Science at St. Edwards University (March 2011), Rice University (December 2011), and Texas Southern University Research Week (award 1st place for oral presentation April 2011).

Future plans

After graduation I will be applying to Louisiana State University to continue my education and research. I would eventually like to teach at a university to bring the joy biology to others.

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Texas Southern University Science Center. Photo courtesy of the COST website.

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