NJSGC and TCNJ's MUSE Program

" A Partnership in Support of Undergraduate Research "

Bijan Sepahpour, D.E., PE
Professor and Chair, ME Department
The College of New Jersey (TCNJ)
[Liaison and Campus Representative]

TCNJ
The College of New Jersey
Established on February 9, 1855

Green Hall

Located in Ewing Township, NJ

Map of the Campus

Institutional Highlight:

- Established on February 9, 1855,
- 289 Acres of wooded land,
- Two Lakes,
- 6,244 Undergraduate Students (188 PT),
- 705 Graduate Students (601 PT),
- Highly Residential
- 343 Full Time Faculty Members,
- 390 Full Time Staff,
- Seven (7) Schools,
- Offers degrees in over 50 liberal arts and professional programs.

TCNJ is organized into seven schools;

- School of Arts and Communication
- School of Business
- School of Humanities and Social Sciences
- School of Education
- School of Nursing, Health & Exercise Science
- School of Science
- School of Engineering

School of Business

Science Complex

Armstrong Hall (Engineering)

TCNJ Library

Provides Residence for all Freshmen and Sophomores and……

Lakes Ceva and Sylva

TCNJ - Recognized for Excellenc

Barron's, Again, Ranks TCNJ with Among the 75 schools in its **"Most Competitive"** category.

U.S.News America's Best Colleges 2010

No. 1 public institution in the region of the country by U.S. N World Report.

TCNJ Tops U.S. News List of Best Colleges for **17th Consecutive Year**
Barron's Names TCNJ a "Best Buy in College Education"

The Princeton Review

TCNJ makes Princeton Review Colleges', '**Happiest Students** '**Most Beautiful Campus**' lists

Kiplinger's PERSONAL FINANCE

Kiplinger's Personal Finance Names TCNJ the **Top Value** Among New Jersey Colleges and Universities

Featured in FISKE

Fiske Guide to Colleges praises

Undergraduate Costs (2010-11)

Tuition and Fees	Room and Board	Total Cost per Year
New Jersey residents $13,549	$10,358 Base plan (Carte Blanche)	New Jersey residents $23,907
Out-of-state students $22,935		Out-of-state students $33,293

School of Engineering Programs

Engineering Majors

- Civil Engineering (ABET)
- Electrical Engineering (ABET)
- Computer Engineering (ABET)
- Mechanical Engineering (ABET)
- Engineering Science (ABET)
  - Biomedical Engineering option
  - Engineering Management option
- BA Biomedical Engineering

Education Majors

- Technology/ Pre-engineering Education
- M/S/T K-5 Certification (NCATE)

Curricular Highlights

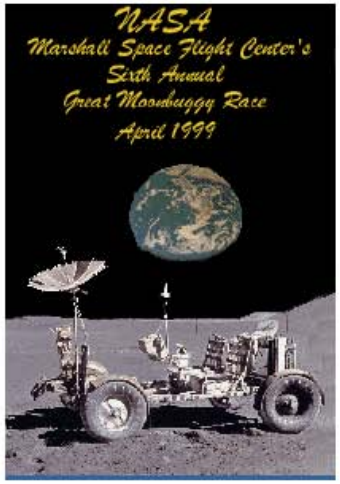
- First year common for engineers
- First year design courses
- Entrepreneurship
- Interdisciplinary Projects
- Our Teacher-Scholars engage students in research
  - Capstone Design Projects
  - MUSE
  - Extracurricular
- Combined 7 Year Engineering/MD Program

Great Moon-buggy Race

A NASA Sponsored National Competition

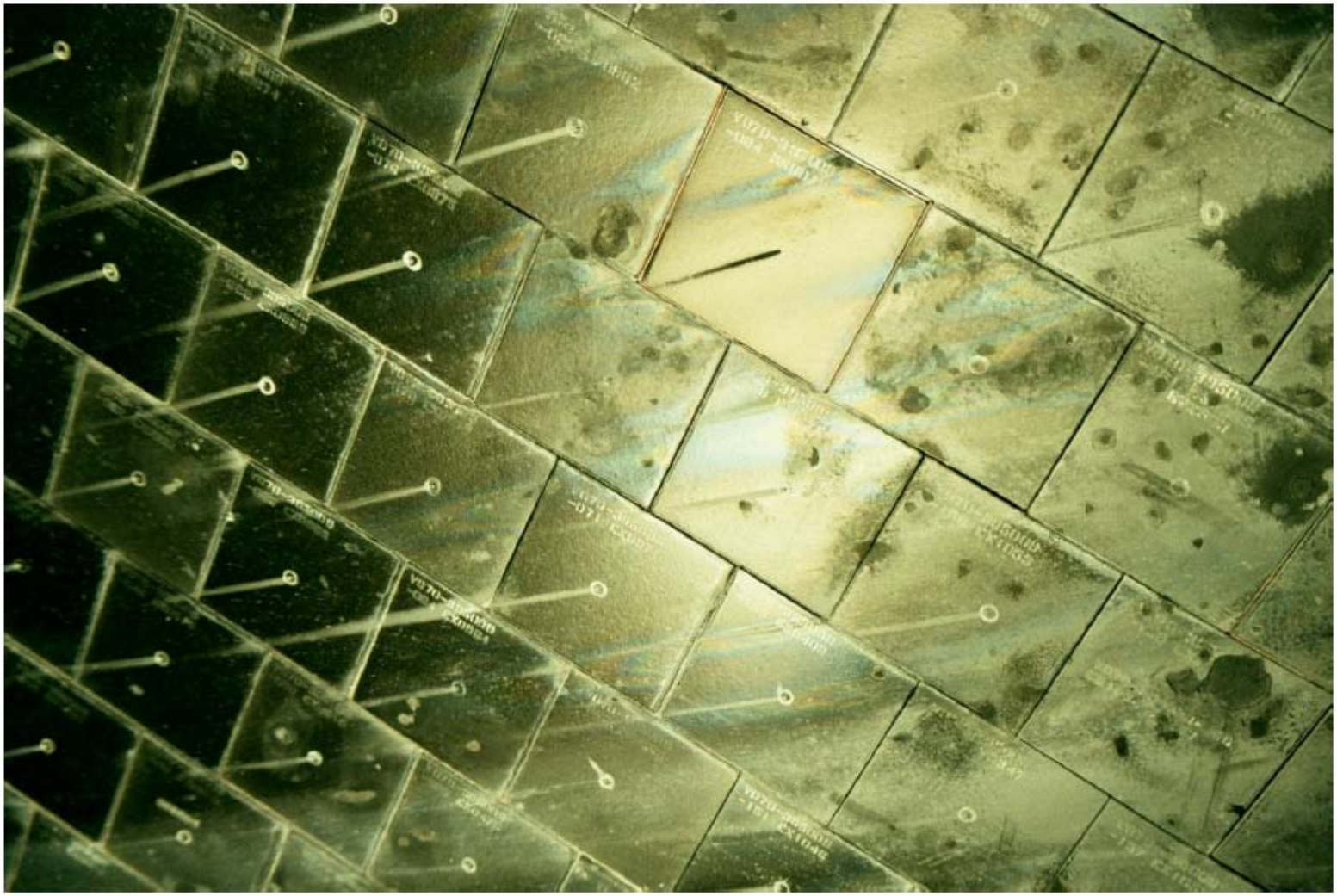
Lunar Rover (NASA Competition):

2002: First Place for Engineering Design - University Category
2001: Third Place Overall
2000: First Place Overall
1999: First Place for Engineering Design – University Category
1998: First Place Overall




AIAA
Great Moonbuggy Race
1999 Best Design Award
University Category
MOON BUGGY COMPETITION
AIAA
2002
Great Moonbuggy Race
Best Design Award
University category
MOON BUGGY COMPETITION
2001 WINNING TEAM

What are Theses?



Beyond Engineering…

- Liberal Learning Options
  - 20 Interdisciplinary Concentrations
    - E.g. Cognitive Science, Environmental Studies, …

- Scholar-Athletes
  - Varsity (20 teams)
  - Intramural & Club
- Scholar-Artists
  - Music ensembles
  - Art Department

NJSGC and TCNJ

- First Contact Made in 2008
- Two Academic Grants in 2008 at $2,000 Each,
- Two Academic Grants in 2009 at $2,000 Each,
- Five Academic Grants in 2010 at $2,000 Each,
- Four Senior Projects Supported in 2010 at $900 Each,
- Six Grants to the MUSE Program in Summer of 2011 at $2,500 Each,
- Total of $36,600 in the past three (3) Years.

Choice of the Projects and the Award Receipients?

Care has been taken to qualify projects that:

1. The nature of their activity and the “end results” properly map into the overall mission of NASA,

2. Their applicants meets the standards of the mentors and requirements of NASA.

Dusty Plasma Experiment (DPX)

TCNJ Physics and ME Department students in collaboration with the Princeton Plasma Physics Laboratories' Educational Department.

TCNJ was chosen as one of the only 14 Colleges and Universities to perform this experiment on board of the (near) Zero-Gravity NASA Jets for three (3) consecutive years.

In the final (third) year, the team succeeded in collecting sufficient data to prove their hypothesis.

The Female and the Minority Factor in the Academic Grants and the Senior Projects

Year	Grant Type	# of Grants	Female %	Minority%
2008	Academic	2	50%	X
2009	Academic	2	50%	X
2010	Academic	5	40%	X
2010	Senior Project	4	X	50%

TCNJ
"Mentored Undergraduate Summer Experience" (MUSE) Program

- In this experience, the faculty mentors invite eligible students to participate in their research activities throughout the summer period.
- The program requires the qualifying student researchers to remain at TCNJ Campus.
- Students spend ten (10) full weeks at 32 hours/week during this period.
- Students are not allowed to take any summer courses or other internships.

Budget of MUSE

- Each Student Researcher in the MUSE program will receive:
  - 1. A stipend of $2,500,
  - 2. Free housing (valued at $1,365 per student),
  - 3. Project/Research Supplies up to $500 per student.

- Each Faculty Mentor/Adviser receives a $1,000 Stipend per student (or Research project).

Matching For the NJSGC Grants

- The budget is for six students; each will receive a stipend of $2,500. As part of the NJSGC required match, TCNJ agreed to not charge any overhead (F&A costs), as well as to provide:
- 1) free housing (valued at $1,365 per student),
- 2) supplies up to $500 per student, and
- 3) $1,000 for the Faculty Adviser.

Thus, the match that TCNJ provides will exceed the grant amount.

Projects and their Distribution

#	Title of the Project	Faculty Supervisor	Student Researcher	Major	M	F	Minority	GPA
1	Production and Characterization of Electrospun Biopolymer Structures for Purification of Heavy Metals from Water	Dr. Matthew Cathell	Melissa Bradley	Technological Studies MST		√		3.905
2	Development of a Novel Ring Forming Reaction	Dr. David Hunt	John Farrokh	Chemistry	√			3.50
3	The Effect of Disturbed Blood Flow Patterns on Thrombosis	Dr. Constance Hall	Melissa Calt	Biomedical Engineering		√		3.717
4	Polymorphism in Cocrystals	Dr. Heba Alrahma	Mr. Jesus Melendez	Chemistry			√	3.22
5	Modeling and Simulation of Smart Grids – Power Systems with Automation, Distributed Generation, Renewable Energy, and Energy Storage Capability.	Dr. Anthony Deese	Audrey Baricko	Electrical Engineering		√		2.724
6	Synthesis of New and Less Expensive Homogeneous Nickel Catalysts for Alkene Hydrogenation.	Dr. Abby O'Connor	Katherine McGarry	Chemistry		√		2.689

The Female and the Minority Factor

- In the Collaborative efforts of the Summer of 2011, the following ratios have been achieved:
  - Female Ratio: 4/6
  - Minority Ratio: 1/6
  - Total of (non-Repeated) Female+Minority Ratio: 5/6

1. Production and Characterization of Electrospun Biopolymer Structures for Purification of Heavy Metals from Water

- Our research is in the area of polymer electrospinning, a process in which micro- or nano-scale fibers are fabricated from polymer solutions in a high voltage electric field. Among the many applications of these minuscule fibers, we are most interested in their strong potential for high-efficiency, low-power water purification technologies, which we believe would be of great use aboard spacecraft, as well as in lunar and planetary support systems. Our investigations will focus on electrospinning biopolymers alginate and chitosan, two natural materials known for their remarkable capacity to bind and sequester heavy metals. We aim to electrospin water-stable fibers specially tailored for maximal sorption of harmful dissolved metal ions.
- This project is being carried out by Matthew Cathell, assistant professor of Technological Studies, in collaboration with Ms. Melissa Bradley, a Technology Education/Pre-Engineering major. This project will afford Ms. Bradley, who is training to become a K-12 STEM educator, with an opportunity to engage in meaningful research that applies math and science principles to engineer a technological solution to the pressing human problems of water resource management and contaminant remediation. Ms. Bradley is also interested in experiencing the research enterprise as she prepares to complete her undergraduate career and considers graduate studies.

Project #2

#	Title of the Project	Faculty Supervisor	Student Researcher		Type of Support Amount ($)
			Major	GPA	
2	Development of a Novel Ring Forming Reaction	Dr. David Hunt	Mr. John Farrokh		Development of a Novel Ring Forming Reaction
			Chemistry	3.50	

2. *Development of a Novel Ring Forming Reaction*

- The object of this proposal is to develop a new method to prepare fused tricyclic ring systems (a 7 membered ring fused on two sides to 6 membered rings) from systems containing two 6-membered rings. This strategy entails building the central ring from the outside in. The primary interest in pursuing this methodology is that very few compounds within these classes have been prepared due to the chemical inefficiencies associated with current routes[1-3]. Furthermore, many of these types of compounds have been found to exert therapeutic effects on the central nervous system to treat anxiety or schizophrenia, so there exists a need for the development of efficient chemistry to enable a thorough study of these systems.
- The ability to form cyclic organic structures is a key strategy for the design of molecules possessing unique properties. This research focuses on the development of a cyclization strategy which enables the formation of a 6,7,6 tricyclic ring system. The ability to develop and optimize such a strategy may be of interest for the design of organic molecules with specific material properties (i.e., engineered materials) which may find applications in NASA's endeavors.

Project #3

#	Title of the Project	Faculty Supervisor	Student Researcher		Type of Support Amount ($)
			Major	GPA	
3	The Effect of Disturbed Blood Flow Patterns on Thrombosis	Dr. Constance Hall	Ms. Melissa Calt		Summer Stipend $2,500
			Biomedical Engineering	3.717	

3. The Effect of Disturbed Blood Flow Patterns on Thrombosis

- The cessation of bleeding by the formation of blood clots is essential to life and occurs normally when blood vessels are breached. However, pathological formation of blood clots, known as thrombosis can lead to morbidity and mortality. Examples include heart attacks and strokes. Within the broader context of this research, the summer MUSE program will have the following specific aims:
- A. Generate microparticles from cultured cells and obtain sufficient supply to begin flow experiments,
- B. Characterize prothrombotic nature of microparticles,
- C. Perform preliminary flow studies with whole blood and microparticles.
- A potential "future" correlation of this study with the general mission of NASA may be the long term effects of the Zero-Gravity environment on astronauts who would be spending extended number of months (or even years) in space stations, etc.

Project #4

#	Title of the Project	Faculty Supervisor	Student Researcher		Type of Support Amount ($)
			Major	GPA	
4	Polymorphism in Cocrystals	Dr. Heba Alrahma	Mr. Jesus Melendez		Summer Stipend $2,500
			Chemistry	3.22	

4. Polymorphism in Cocrystals

- Polymorphism is a phenomenon that arises from the ability of a substance to exist in more than one form of Solid State. Both Polymorphic and Non-Polymorphic Cocrystals have been reported in the literature, but it is difficult to determine the Polymorphc tendency of Cocrystals because of the small pool of data available since this field is still in its infancy. It is our objective to investigate Cocrystals of Polymorphic Compounds to better understand their Polymorphic tendencies and help answer the question *can Cocrystals control Polymorphism?* Up to this point, we have been successful in preparing 6 new Cocrystals of PZA all of which appear to be Non-Polymorphic. The Cocrystal formers (and co-formers) we employed for these Cocrystals belonged to one family of compounds. This summer we will focus on preparing Cocrystals of PZA with new co-formers that belong to a different family of Compounds. This should expand our library of the PZA Cocrystals. Should the team succeed in achieving its objectives, the tested process may be adopted by agencies such as NASA to build on it and explore diverse potential applications.

Project #5

#	Title of the Project	Faculty Supervisor	Student Researcher		Type of Support Amount ($)
			Major	GPA	
5	Modeling and Simulation of Smart Grids – Power Systems with Automation, Distributed Generation, Renewable Energy, and Energy Storage Capability.	Dr. Anthony Deese	Ms. Audrey Baricko		Summer Stipend $2,500
			Electrical Engineering	2.724	

5. Modeling and Simulation of Smart Grids – Power Systems with Automation, Distributed Generation, Renewable Energy, and Energy Storage Capability

- The MUSE project mentored by Dr. Anthony Deese provides a unique opportunity for undergraduate student to learn about and participate in innovative research related to power system modeling and state estimation. Specifically, the students will examine methods to implement these methods via digital computer and microcontroller. Although the project is framed to examine terrestrial power systems, it examines issues and analyses which also apply to smaller-scale military and satellite power distribution systems.

- The students utilization of microcontroller technology demonstrates potential for implementation in environments where space and power are limited. As such, this research is very relevant to the aims of agencies such as NASA. The College of New Jersey has a strong electrical engineering program – one which has seen renewed focus on power and energy issues in recent years. With NJSGC funding, it is expected that this MUSE project will yield positive results soon. However, the faculty and students also have plans for long-term research beyond the summer season.

Project #6

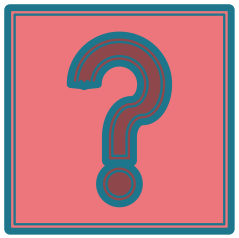
#	Title of the Project	Faculty Supervisor	Student Researcher		Type of Support Amount ($)
			Major	GPA	
6	Synthesis of New and Less Expensive Homogeneous Nickel Catalysts for Alkene Hydrogenation.	Dr. Abby O Connor	Ms. Katherine McGarry		Summer Stipend $2,500
			Chemistry	2.689	

6. Synthesis of New and Less Expensive Homogeneous Nickel Catalysts for Alkene Hydrogenation

- This project focuses on the synthesis, characterization, and application of new homogeneous transition metal catalysts. In particular, we are interested in developing new, less expensive technologies in order to perform reactions that are typically catalyzed by more expensive and less abundant metals. This research project is driven by mechanistic studies, which will allow us to design better and more efficient catalysts for the future. Future applications of this research include the preparation of novel materials as well as the development and utilization of alternate materials for fuels and chemicals. The catalysts may also be of interest to NASA's fuel cell applications.

NJSGC and TCNJ's MUSE Program

(A Partnership in Support of Undergraduate Research)



Bijan Sepahpour
The College of New Jersey (TCNJ)
NJSGC Conference – 2011