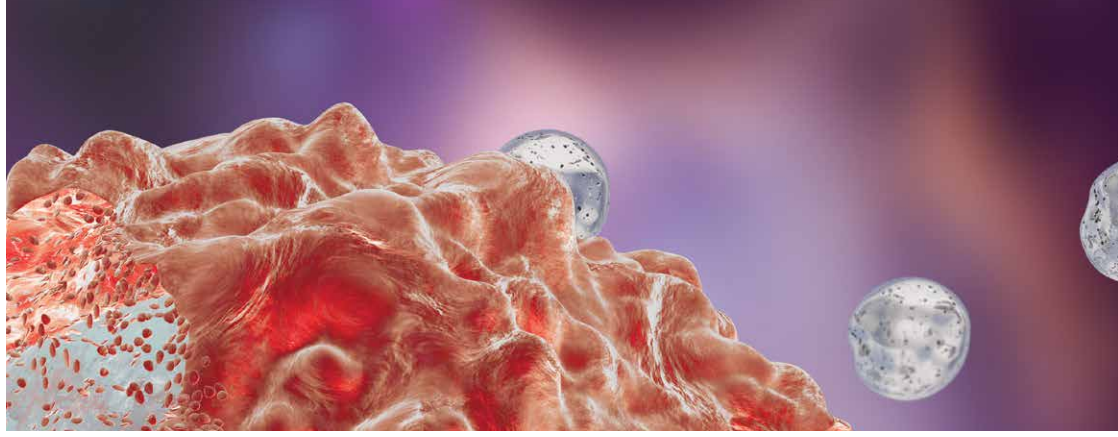


Fall 2018



# A World-Class Technological Research University



IMPROVING  
NANODRUG  
DELIVERY



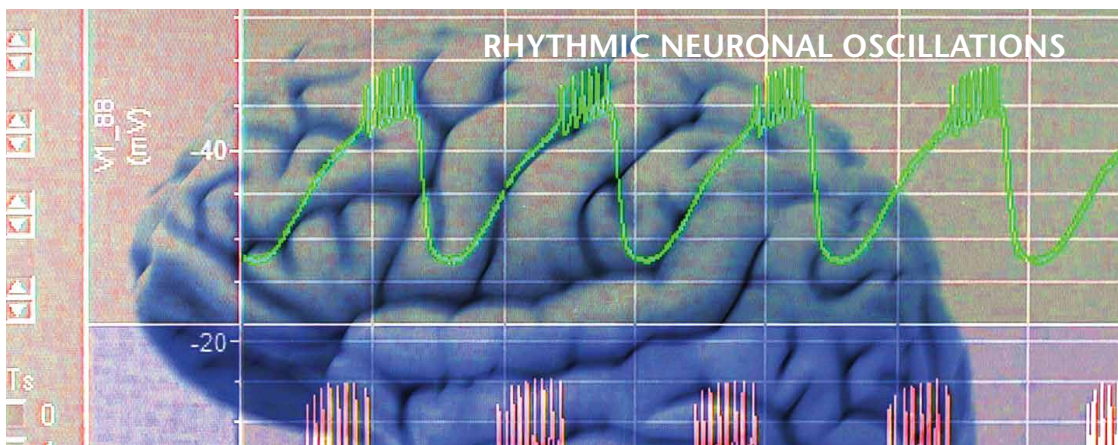
PREDICTING  
PATIENT  
RESPONSE



SCIENCE OF DIET  
COMPLIANCE



PLANNING  
URBAN  
SPACES



RHYTHMIC NEURONAL OSCILLATIONS



# RESEARCH SNAPSHOTSHOTS



## forensic science

first undergraduate degree program offered in New Jersey

### Promoting Open Source Knowledge Collaboration

Gelu Nita, Vincent Oria and Alexander Kosovichev aim to foster new collaborations between heliophysicists and cyber/computer scientists in support of the National Science Foundation's (NSF's) EarthCube initiative to transform research in the academic geosciences community. Their goal is to improve scientific outcomes through new ideas, methodologies and tools for integrating and analyzing the large amounts of data generated by space and ground-based observatories and supercomputer modeling centers.



### Documenting the Credit Risk of Car Loans

Ming Fang Taylor focuses on behavioral research in accounting using big data. She recently explored bank "stress testing" — the analysis to determine whether a bank has enough capital to withstand economic upheaval — for portfolios of car loans. Her work, which has implications for regulators, financial institutions and others modeling car-loan risk, showed that the probability of defaults jumps significantly after five years.



### Designing Economic Incentives for Sustainable Energy Systems

Selina Cai studies the effect of market-based incentives on the implementation of carbon capture and storage systems, which are meant to reduce carbon emissions from coal and natural gas power plants. Her research may help leaders evaluate relevant public policies



and accelerate implementation of carbon capture and storage technologies.



### Examining Exclusion and Inclusion in Urban Spaces

Georgeen Theodore studies urban planning and the factors that shape the built environment. Together with colleagues, she examines the policies, practices and physical tools used to limit — or open — access to public, private and shared spaces. These range from the design of public parks to zoning and parking restrictions, among others.

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## \$170 MILLION

in research expenditures annually

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## 5,200<sup>sq.</sup>ft.

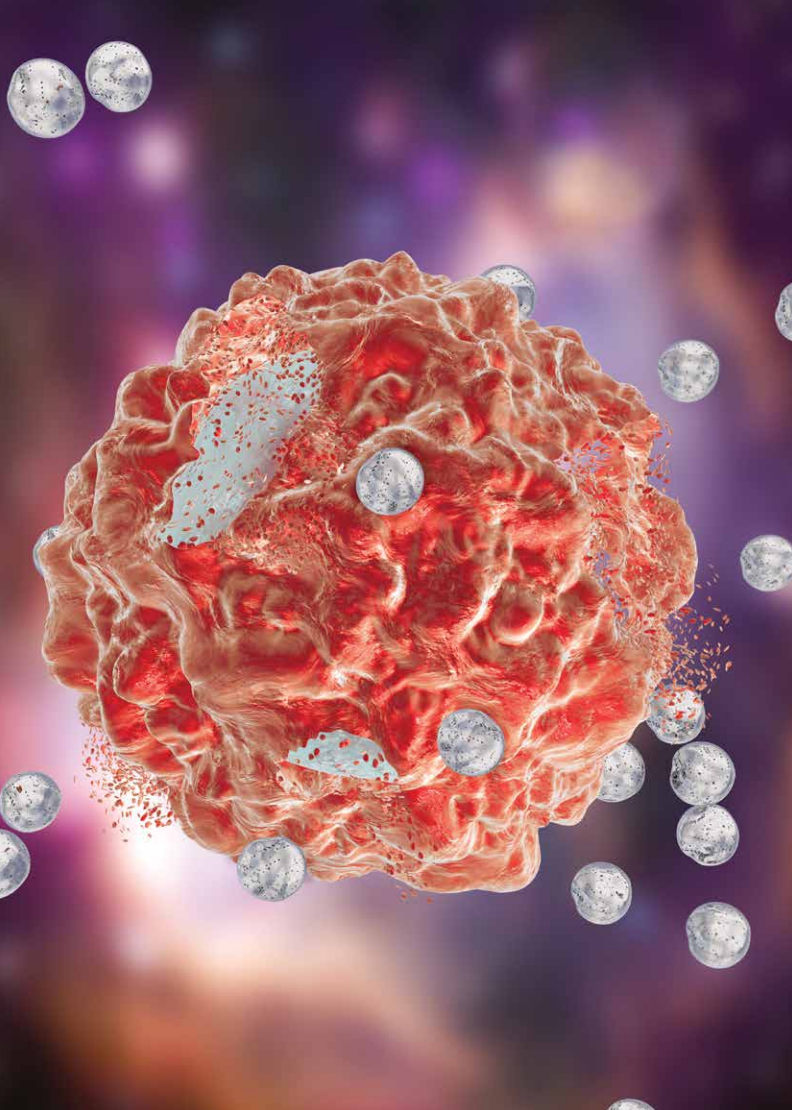
new gene cell therapy lab in development

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## 82%

increase in external academic research funding since 2014



## Improving the efficacy of nanopharmaceuticals

In the fight against cancer, nanoparticles — particles a millionth of an inch in size — are modern weapons in targeting and delivering drugs to cancerous cells. But today it's not just a particle's size that matters. It's also the particle's shape, coating, surface structure and how it interacts with chemicals in the



body. This ability to engineer nanoparticles with such precision and variability is revolutionizing drug development. It also drives the research of NJIT's **Kathleen McEnnis**, assistant professor of chemical and materials engineering in the university's Newark College of Engineering.

Dr. McEnnis' earlier research modified nanoparticles with antibodies and incubated them with a breast cancer cell line to penetrate cancer stem cells more effectively. Her current research explores how nanoscale polymer drug delivery systems behave inside the body. Using physical chemistry techniques in novel ways, she is studying how nanoparticles interact with cells, blood and proteins and how they respond to changes in physiological temperature. She has also devised an innovative method of analyzing and quantifying polymer particles in blood plasma and is studying what material properties create more successful drug delivery systems.



## Predicting how cancer patients respond to drugs

The research of **Zhi Wei**, assistant professor in NJIT's Ying Wu College of Computing, may help oncologists determine the best course of treatment for each of their patients. The goal is to significantly improve outcomes and offer more precise cancer care based on data. An expert in advanced data analytics, Dr. Wei applies data mining, statistical modeling and machine-learning techniques to clinical data to predict how cancer patients will respond to drugs.



In a recent study, his novel algorithms have been able to predict and anticipate drug sensitivity in multiple myeloma and breast cancer patients, outperforming existing alternative approaches. What's more, Dr. Wei's method may be applied to a wide range of tasks. These include integrating data from electronic health records and various social media platforms (e.g., Twitter and Facebook) to predict future health conditions of patients.

Dr. Wei's work on machine learning for complex data-mining applications is highly relevant to fields well beyond medicine and health care, and range from digital marketing and social media to real estate.





## Using machine learning to prevent dietary lapses

The abundant wellness and diet apps that exist today can do everything from assessing fitness and creating workout plans to counting calories and monitoring weight loss. But can an app also prevent a lapse when you're trying to stick to a diet?

**Pramod Abichandani**, assistant professor of engineering technology in NJIT's Newark College of Engineering, has been working with colleagues on a smartphone-based system that uses artificial intelligence to accurately predict dietary lapse behavior and deliver tailored just-in-time interventions.



Dr. Abichandani's research interests center on optimal, multidimensional, data-driven decision-making through the use of techniques from mathematical programming, linear and nonlinear systems theory, statistics and machine learning. He has investigated intelligent

systems to detect and treat deep vein thrombosis (when a blood clot forms in one or more of the body's deep veins, usually in the legs) as well as impending hypoxia (when blood doesn't carry enough oxygen to tissues to meet the body's needs) in military personnel.



## Decoding the electrical signature of neural networks

High-level brain functions, such as learning, problem-solving and coordinated muscle movement, depend on neurons working together in networks. Changes in the electrical signature of these neural networks have been shown to correlate with a variety of neurological conditions like epilepsy, Parkinson's disease and dementia.



To better understand these neuronal circuits, NJIT's **Horacio Rotstein** is developing computational models to test against in vivo experiments at a university in Israel. The research focuses on the electrical signature of neural activity in the parts of the brain involved in memory, learning, language and motor generation.

A professor of biological sciences in NJIT's College of Science and Liberal Arts, Dr. Rotstein's collaborative research is funded by the National Science Foundation (NSF) and the U.S.-Israel Binational Science Foundation (BSF).

Dr. Rotstein's research will contribute to the understanding of the neuronal circuits that underlie the generation of rhythmic oscillations and will have implications for cognitive and motor function in both health and disease.



# NJIT recognizes the exemplary work of three researchers

NJIT professors Dale Gary, Edward Dreizin and Farzan Nadim were recently awarded the university's highest and most prestigious accolade, the 2018 Excellence in Research Prize and Medal.

Dale Gary is a distinguished professor of physics, the director of NJIT's Expanded Owens Valley Solar Array (EOVSA), a leader in radio astronomy and the author of more than 100 articles in scholarly journals. Dr. Gary spearheaded the expansion of EOVSA near Big Pine, California, from its old complement of seven antennas to a total of 15 and the replacement of its control, wiring and signal-processing systems with newly developed technology to create a world-class facility for scientific research on the Sun. His investigations of the solar atmosphere during both quiescent times and during solar flares are of national interest and have furthered understanding of the Sun's influence on the Earth and near-Earth space environment — a subject broadly termed Space Weather. His contributions to the field of solar science, underwritten by the National Science Foundation (NSF) and NASA, include the development of a modeling framework that creates a 3D picture of what's occurring in a solar flare and the improved ability to "nowcast" solar flares and their potential impact on Earth. Moreover, data from EOVSA is used by researchers around the world and in combination with data from NASA spacecraft and other ground-based instruments.

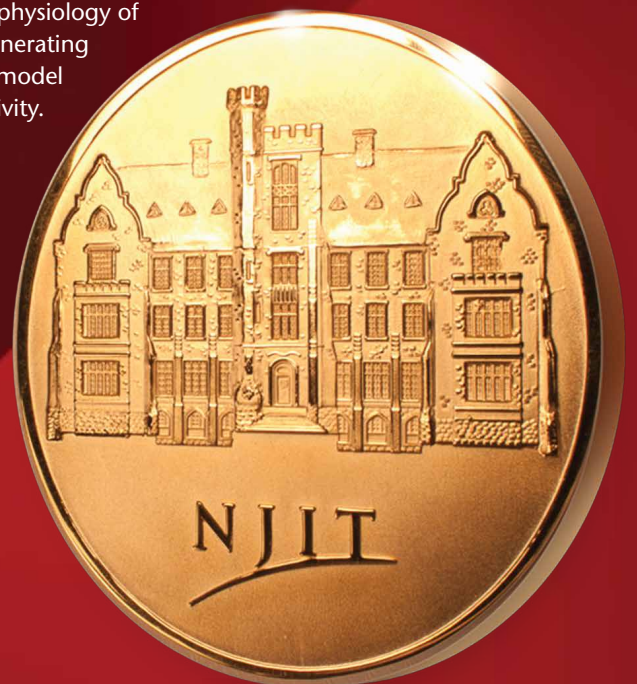


Edward Dreizin, a distinguished professor in the Otto H. York Department of Chemical and Materials Engineering, develops novel energetic compounds for use in advanced propellants, explosives and pyrotechnics. In his Reactive and Energetic Materials Laboratory, Dr. Dreizin creates these compounds by milling together distinct metal-based materials, generating nanocomposites with unique properties. Applications of his mechanochemical syntheses range from engineered alloys that can serve as agents to neutralize anthrax, for example, to better rocket propulsion fuels, to new technologies for hydrogen generation. In conventional energetic materials, metallic fuel requires an oxidizer to achieve combustion, and the oxidizing agent is often an environmental pollutant. Dr. Dreizin's study of new energetic compounds may help reduce these environmentally undesirable emissions. Another key area of his research is the combustion mechanisms of metallic fuels, including detailed mechanistic modeling of the ignition and combustion of individual particles. Dr. Dreizin's work has been supported by a number of state and federal agencies, including the U.S. military, as well as private industry.



Farzan Nadim, a professor of neurobiology and a founding director of NJIT's Institute of Brain and Neuroscience Research, focuses on understanding how a network of neurons can produce a variety of outputs in a dynamic manner that correspond to different behaviors. His aim is to uncover the fundamental principles that govern neural processing across all animal and human nervous systems. Dr. Nadim's experimental research has been primarily on the neurophysiology of the stomatogastric ganglion, a small central-pattern-generating neural circuit in lobsters and crabs that has served as a model system for studies of circuit dynamics and oscillatory activity.

His work may shed light on neurological disorders such as epilepsy, Parkinson's disease and schizophrenia. In addition, new research on neuromodulators — chemicals released within the nervous system — and how they modify the properties and outputs of neural networks may help others working on next-generation drug development through greater knowledge on the cellular and network level of how drugs developed to treat the brain interact with each other as well as with chemicals that originate in the body.





# Q&A

**Fadi P. Deek**

**NJIT Provost and Senior Executive Vice President**

Fadi P. Deek was appointed NJIT provost and senior executive vice president in June 2013. He received his bachelor's in computer science from the university in 1985, his master's in 1986 and his Ph.D. in computer and information science in 1997.

*One of the nation's leading public technological universities, New Jersey Institute of Technology (NJIT) is a top-tier research university that prepares students to become leaders in the technology-dependent economy of the 21st century. NJIT's multidisciplinary curriculum and computing-intensive approach to education provide technological proficiency, business acumen and leadership skills. With an enrollment of 11,560 graduate and undergraduate students, NJIT offers small-campus intimacy with the resources of a major public research university. NJIT is a global leader in such fields as solar research, nanotechnology, resilient design, tissue engineering and cybersecurity, in addition to others.*

## **The university recently published its 2020 Vision Mid-Cycle Review. Can you briefly discuss the successes to date?**

We have achieved success in each of our strategic priorities. With a total of 8,100 freshman applications for fall 2018, we have surpassed our target by 33 percent. Moreover, our efforts have resulted in a 4 percent increase in retention rate (to 88 percent) and a 6 percent increase in six-year graduation rate (to 65 percent). In addition, the percent of bachelor's degree recipients who have jobs six months after graduation has reached the 2020 target of 65 percent. Another 25 percent of bachelor's degree recipients enter graduate programs within six months. We also have emphasized learning outcomes assessment for our degree programs, resulting in 85 percent of all programs currently being assessed.

We have transformed into a nationally ranked research university. Externally funded research has increased 70 percent, from \$63 million in 2014 to \$107 million in 2018, and our 20 doctoral programs boast a total enrollment of over 480 students in fall 2018. In the past seven years, 128 faculty have been hired, and 44 percent of our current faculty were hired in the past 10 years, bringing the total number of research faculty above 300. We have also made substantial investments, including \$75 million in strategic plan activities alone. Between 2014 and 2018, we also invested nearly \$400 million in the expansion and upgrade of facilities, resulting in almost 1 million square feet of new space.

## **Can you specifically discuss the progress in research?**

NJIT continues to recruit and retain exceptional faculty, as well as encourage and support multidisciplinary collaborations. This year we continued to grow the number of collaborations, with 35 projects involving researchers from multiple departments — twice the 2020 target. Moreover, our faculty members are producing an average of 2.6 refereed publications per year, and the number of prestigious faculty awards has exceeded our 2020 target.

Our faculty is bringing diverse research expertise to NJIT and actively engaging with colleagues abroad, increasing the number of international research collaborations from a baseline of 24 in 2014 to 63 in 2018. Our university also values entrepreneurial research, supports inventions, and facilitates technology transfer through its Enterprise Development Center. Three years ago we set ambitious goals for research at NJIT. It is incredible to see how far we have come, particularly in the face of declining federal dollars for research.

## **What are some trends in higher education that affect research and how has NJIT addressed them?**

In recent years, obtaining research funding, particularly federally financed research funding, has become increasingly competitive. We have addressed this challenge by placing greater emphasis on applied research in those areas where we are acknowledged leaders. As a result, funded research in computing, engineering and science has grown significantly. In addition, hiring faculty with leading skills in their fields and equipping them with state-of-the-art research facilities has enabled NJIT to compete for and win many more grants.

## **NJIT has moved up 34 positions in the 2019 U.S. News & World Report Top National University rankings — the third-highest jump in the rankings history. What contributed to this success?**

By improving the student experience, we have significantly moved our retention and graduation rates and shown that NJIT is comparable to America's best public universities. We have also been recognized for the upward economic mobility of our students by both The New York Times and Forbes. We believe that our commitment to supporting students in the lowest income brackets has had a significant positive impact on our ranking increase.

In the areas of research and scholarly productivity, NJIT has also achieved exceptional results with externally funded research, putting us firmly in the ranks of America's finest research universities. The lesson we learned from this ranking is that you can't just talk about being comparable to the top universities in the country. You have to offer a top university experience to your students and faculty if you want to reach that level.

### **Stories of Innovation**

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