Finding better treatments for parasitic diseases

Elephantiasis, or lymphatic filariasis, is a parasitic disease infecting more than 120 million people in the tropics. According to the World Health Organization, nearly 40 million of them are disfigured and disabled by the infectious disease. Characterized by elephantine enlarged limbs and thickened skin, lymphatic filariasis is caused by a parasite transmitted to humans by mosquito bites.

During the last five years, John Siekierka, Montclair State chemistry and biochemistry professor and director of the University’s Margaret and Herman Sokol Institute for Pharmaceutical Life Sciences, and Sokol Professor of Chemistry David Rotella have received more than $932,000 in grant funding from the Celgene Corporation Division of Global Health to find effective new treatments for the disease.

“New treatments are needed because the existing drugs are not completely effective and have side effects that limit their use,” says Siekierka.

Determining the means by which parasites such as Brugia malayi – the roundworm parasite responsible for elephantiasis in South and Southeast Asia – avoid host immune responses, can potentially lead to effective new therapeutic treatments.

continued on page 3
Steps toward a Parkinson’s cure

While little is known about the function of the protein alpha-synuclein in healthy brains, it is present not only in the abnormal protein clusters that characterize Parkinson’s disease called Lewy bodies, but also in protein deposits associated with Alzheimer’s disease.

The same molecular process applied to different proteins is suspected to be at the root of other incurable neurological diseases including Huntington’s, ALS and Creutzfeldt-Jakob disease.

Chemistry and Biochemistry Professor David Talaga has received a $283,000, one-year “bridging award” from the National Institute of Neurological Disorders and Stroke to study the interfacially activated aggregation of alpha-synuclein. This additional data will help him build the case for his five-year research project grant application to study the aggregation of proteins on surfaces that can lead to the formation of plaque in cells implicated in neurological diseases.

“Aggregation is when proteins form a tightly bound group that can grow into a slender fiber, or fibril. By focusing on how solid-liquid interfaces influence the aggregation and fibrillization of alpha-synuclein, Talaga hopes to identify the molecular steps that initiate the process.

Montclair State’s Department of Psychology and the Kessler Foundation of West Orange are collaborating on a yearlong program that provides students with unique, hands-on research internship opportunities helping people with cognitive brain disorders.

Psychology Professor Ruth Propper, director of Montclair State’s Cerebral Lateralization Laboratory, established the program last fall with the Kessler Foundation, a public charity dedicated to changing the lives people with physical and cognitive disabilities.

“Psychology Professor Peter Vietze, through his contacts there, invited me to visit Kessler with him as he felt that my work and theirs might lead to natural collaborative opportunities,” recalls Propper, whose cognitive research has also been used by the United States Army and the Department of Defense to help keep soldiers safe through memory enhancement techniques.

The collaboration with the Kessler Foundation allows for seven Montclair State graduate students to receive course credit as interns while working on diverse projects aimed at improving the lives of people disabled by strokes, multiple sclerosis, traumatic brain and spinal cord injuries and other chronic conditions. The students work with Kessler Foundation researchers to explore new means of lessening the effects of neurological damage on cognition and emotion.

The interns work on projects involving wearable battery-powered robotic exoskeletons used to help stroke victims regain mobility and are exploring the use of a low-cost, customized virtual-reality rehabilitation tool to help improve the balance of traumatic brain injury patients.

The Kessler Foundation is equipped with a research imaging center, and Montclair State interns are involved with neuroimaging projects — using magnetic resonance imaging (MRI) and other techniques — aimed at improving the mobility and cognition of the disabled.

Improving the lives of the disabled

Montclair State's Department of Psychology and the Kessler Foundation of West Orange are collaborating on a yearlong program that provides students with unique, hands-on research internship opportunities helping people with cognitive brain disorders.

Psychology Professor Ruth Propper, director of Montclair State’s Cerebral Lateralization Laboratory, established the program last fall with the Kessler Foundation, a public charity dedicated to changing the lives people with physical and cognitive disabilities.

“Psychology Professor Peter Vietze, through his contacts there, invited me to visit Kessler with him as he felt that my work and theirs might lead to natural collaborative opportunities,” recalls Propper, whose cognitive research has also been used by the United States Army and the Department of Defense to help keep soldiers safe through memory enhancement techniques.

The collaboration with the Kessler Foundation allows for seven Montclair State graduate students to receive course credit as interns while working on diverse projects aimed at improving the lives of people disabled by strokes, multiple sclerosis, traumatic brain and spinal cord injuries and other chronic conditions. The students work with Kessler Foundation researchers to explore new means of lessening the effects of neurological damage on cognition and emotion.

The interns work on projects involving wearable battery-powered robotic exoskeletons used to help stroke victims regain mobility and are exploring the use of a low-cost, customized virtual-reality rehabilitation tool to help improve the balance of traumatic brain injury patients.

The Kessler Foundation is equipped with a research imaging center, and Montclair State interns are involved with neuroimaging projects — using magnetic resonance imaging (MRI) and other techniques — aimed at improving the mobility and cognition of the disabled.
Testing the waters

Autonomous - or robotic - ocean vehicles have become indispensable when it comes to tasks like coastal mapping, environmental monitoring, harbor and port security and oil field surveying. Yet, according to Montclair State Mathematical Sciences Professor Eric Forgoston, unpredictable and variable currents, weather events and other random influences can make it difficult to position autonomous underwater and surface marine vehicles.

“Objects in moving fluids rarely go with the flow.”
–Eric Forgoston

Forgoston received a $299,987 grant in July 2014 from the National Science Foundation for a three-year project to ultimately improve transport control capabilities by addressing the challenges of positioning these vehicles in ocean waters. His project, “Transport of inertial particles in time-dependent and stochastic flows,” will develop computer models of fluid flows and mathematical models of control to determine the best ways to position unmanned ocean vehicles.

“It is important to study the transport of inertial objects in flows because autonomous ocean vehicles and other robotic unmanned sensors have mass that must be accounted for,” Forgoston says. “Objects in moving fluids rarely go with the flow. Instead, they may sink, swim or steer in order to reach a destination, or they may respond to other influences, including their own sizes and shapes.”

Forgoston, the project’s principal investigator, is collaborating with Montclair State Mathematics Professor Lora Billings and Philip Yecko of The Cooper Union on laboratory experiments that will use precisely tuned fluid flows and remotely controlled particles to capture the important effects of a vehicle’s mass, size and shape.

According to Forgoston, taking advantage of the ways that real objects interact with flows enables a wide range of technologies. “On small scales, micro robots may be steered inside the human body to perform surgery. On the largest scales, ocean drifters may monitor currents, marine life or global weather patterns.”

The project has broad-ranging implications for the future. Forgoston explains, “The payoff is significant in that a better-monitored ocean is advantageous to fishing and shipping, the military and environmental monitoring.”

Finding better treatments for parasitic diseases
continued from page 1

The Sokol Institute and Celgene Global Health recently renewed a formal agreement to fund this research for another year.

“We are collaboratively investigating inhibition of a parasitic protein kinase for potential treatment of lymphatic filariasis,” explains Siekierka. In addition to Celgene, University researchers are working with the Filaria Research Reagent Resource Center at the University of Georgia and the Drugs for Neglected Diseases Institute in Switzerland to find an effective new treatment for lymphatic filariasis.

Siekierka’s team had previously identified a protein kinase that the Brugia malayi worm needs to protect itself from destruction by the host’s immune system. By inhibiting this protein kinase, the worm would quickly die and the disease would be treated.

“We have identified molecules that are now being investigated in a variety of animal models of these diseases and we have also screened new molecules and are in the process of characterizing their activity against the parasite,” he says. “The research focus is expanding beyond a single potential kinase target to include others.”

Objects in moving fluids rarely go with the flow.
–Eric Forgoston
Social media has become a central feature of social life for most teens – with 95 percent of teens reporting that they have an online presence, allowing them to stay in almost constant contact with their friends and peers.

Family and Child Studies Professor Sara Goldstein, who studies adolescent behavior, says that because of that online connectivity, cyber bullying and cyber aggression have emerged as particular concerns with regard to youth psychosocial adjustment.

Her initial studies and survey of high school students reveal that teens who are secretive with their parents and whose friends are cyber aggressive are more at risk when it comes to engaging in cyber bullying.

“Teens who actively keep aspects of their online lives – as well as aspects of their day-to-day lives – hidden from their parents and who have cyber aggressive friends, are at the highest risk,” she says.

Results of her current study suggest that parents can minimize the risk of their teens becoming cyber aggressive or engaging in other risky behaviors by providing a warm, non-intrusive family environment that encourages parent-child communication.

---

Professor Dibyendu Sarkar, director of the Environmental Management doctoral program, is principal investigator on a two-year, National Oceanic and Atmospheric Administration-funded Healthy Coastal Ecosystems Sea Grant subaward from the New Jersey Sea Grant Consortium on a project using green technology to reduce nutrients and metals in New Jersey’s coastal waters.

In November 2014, Sarkar and co-investigators, colleague Yang Deng; Rupali Datta, the chief R&D officer of Montclair State incubator company SIROM Scientific Solutions; and Manhattan College Professor Kirk Barrett, began to develop best management practices for reducing such pollution.

“Road runoffs typically contain a variety of metals such as copper from brake pads and zinc from tires, as well as nutrients like phosphorus and nitrogen from fertilized agricultural fields, golf courses and lawns that ultimately enter coastal waters without any protection mechanisms,” explains Sarkar. The team plans to use waste material or drinking water treatment residuals in parking lot catch-basins and non-invasive grasses such as vetiver to remove pollutants from stormwater runoff before it enters Barnegat Bay.

“We propose a green solution that will make our coast more resilient to environmental damage.” – Dibyendu Sarkar

According to Deng, more than half of the country’s solid municipal waste or garbage ends up in landfills. When too much rainwater enters these landfills, landfill leachate – a high-strength wastewater that can contaminate soil, ground and surface waters – is invariably produced. Twenty-five percent of New Jersey’s toxic Superfund sites are contaminated by landfill leachate.

“There are strong dissolved organic compounds in leachate that can absorb UV and reduce its disinfection efficiency. The ultimate goal is to find a technically viable and cost-effective solution for solid waste industries,” he says.
Predicting pregnancy risks earlier

Montclair State University Mathematics Professor Diana Thomas and a team of researchers from universities, medical schools and the private sector, are conducting research that could revolutionize obstetric care and make at-risk pregnancies safer. Using geometric equations to measure placental growth, Thomas hopes to be able to predict problem pregnancies much earlier, which could reduce risks to both mother and fetus.

“Currently, complicated pregnancies are treated when symptoms are visible from physical measurements or biomarkers. Often the ball is already rolling and despite best efforts, changing the direction of the pregnancy is impossible,” says Thomas, co-principal investigator. “Mathematical models magnify deviations not otherwise readily detectable earlier, offering a chance to change the course of pregnancy to a healthier and positive outcome. That’s a pretty exciting use of mathematics.”

A normal, healthy placenta grows in a predictable pattern, and the team has learned that abnormal growth can be detected because it falls off the predictive curve. Even in the first trimester, this could indicate problems with the pregnancy such as gestational diabetes or preeclampsia, the later of which, if not caught early, can lead to a sometimes-fatal condition.

“[It] provides a very real opportunity to intervene and change the course of pregnancy toward more positive outcomes.” –Diana Thomas

In both cases, earlier detection would be a breakthrough, Thomas says. “Identifying women at risk for both preeclampsia and gestational diabetes during early pregnancy using non-invasive, routine ultrasound techniques provides a very real opportunity to intervene and change the course of pregnancy toward more positive outcomes,” she says.

Furthermore, the team, comprised of leading experts in placental morphology, obstetrics, mathematics and reproductive physiology, is working to develop the first class of differential equation models that combine 19 placental measures to identify and classify risk for problems in pregnancy. “It’s amazing what we can do with mathematics, but we can’t do it with math alone,” says Thomas, adding that an interdisciplinary team is crucial.

That team includes engineers who extract placental features from images to use in the algorithm; a perinatal pathologist who evaluates the accuracy of model predictions; an OB-GYN who evaluates the course of the pregnancy and the results for use in clinical practice; an applied mathematician and a physicist who simulate through lab experience what can’t be tested on humans; a biostatistician who combines the predictors into a formula to classify pregnancy risk; and a computer scientist who delivers the results through user-friendly software.

“As a perinatal pathologist, I routinely see cases where problems are only recognized for a few days or even a few hours before delivery but the placenta clearly demonstrates pathology of weeks or even months of age,” says Principal Investigator Carolyn Salafia, a perinatal pathologist with Placental Analytics in New York. “This work may allow early identification of at-risk pregnancies and improved fetal childhood and lifelong health.”

The study has been flagged for funding by the Eunice Kennedy Shriver National Institute of Child Health and Human Development, the National Institutes of Health and for an award from the federal Small Business Innovation Research program.
<table>
<thead>
<tr>
<th>Title</th>
<th>Author</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reliving the peacock dinner</td>
<td>English Professor Lucy McDiarmid</td>
<td>Takes a look at a legendary 1914 dinner of seven poets, including Ezra Pound and W. B. Yeats, in <em>Poets and the Peacock Dinner: the Literary History of a Meal</em>. Through research of unpublished letters, diaries, memoirs and poems, McDiarmid reveals how marriage and adultery, as well as friendships, offer ways of transmitting the professional culture of poetry. (Oxford University Press, 2015.)</td>
</tr>
<tr>
<td>Remembering Lovewell’s fight</td>
<td>History Professor Robert Gray</td>
<td>Revisits the 1725 bloody clash between the Colonials and the Abenaki Nation to discuss themes of war, death and memory in Colonial times. Gray examines how a poorly executed military operation marred by questionable battlefield behavior, came to be remembered as early America’s version of the Alamo. (University of Massachusetts Press, 2014.)</td>
</tr>
<tr>
<td>The nature of globalization</td>
<td>Sociology professors Sangeeta Parashar and Yong Wang</td>
<td>In their book <em>Divisions &amp; Integrations: The Expansion of Global Capitalism</em>, they use a theoretical framework focused on systemic capitalist expansion to highlight the paradoxical nature of globalization. Their research focuses on issues of labor, gender, economic inequality, culture, food systems and the environment. (Kendall Hunt Publishing, 2014.)</td>
</tr>
<tr>
<td>Innovative ideas worldwide</td>
<td>Business professors Ram Subramanian and C. N. Jayachandran</td>
<td>Their book <em>Rethinking Innovation: Global Perspectives</em> brings together case studies from around the world and examines a variety of themes, including technological innovation, research and development, team and human resource management, creative process and entrepreneurship development. (Routledge India, 2014.)</td>
</tr>
<tr>
<td>A case for critical thinking</td>
<td>Education Professor Eric Weiner</td>
<td>In <em>Deschooling the Imagination: Critical Thought as Social Practice</em>, Weiner looks at the social/cultural relationship between learning and imaginative capacity and what it means to be actively engaged in developing a critical and creative mindset against the prevailing ideology of public schools. (Paradigm Publishers, 2014.)</td>
</tr>
<tr>
<td>Perspectives on music therapy</td>
<td>Music Professor Karen Goodman</td>
<td><em>International Perspective in Music Therapy Education and Training: Adapting to a Changing World</em> is the first anthology of its kind. In it, Music Professor Karen Goodman pulls together the ideas of noted educators from around the world to speak to the challenge of adapting in ways that affect music therapy education. (Charles C Thomas • Publisher, Ltd, 2015.)</td>
</tr>
</tbody>
</table>
Linguistics Professor Anna Feldman's work in natural language processing provides a link between humans and computers. As a researcher, her work will have direct benefits to machine translation, specifically when it comes to translating figurative speech.

“If you ever use Google Translate, you know machine translation is still not a fully solved problem,” she says. “While getting the structure and form of the translation is difficult, translating figurative language is back-breaking. First of all, the machine needs to detect figurative language, such as an idiom.”

Idiomatic phrases such as “hit the sack,” “eat my hat,” “blow my top” or “go cold turkey” are confusing for computers – and for language learners – to translate because they can often be taken literally, as well as figuratively. “Therefore we need to find a way to tell literal phrases from idiomatic phrases in different contexts,” Feldman says.

With the help of a $176,000 grant from the National Science Foundation, Feldman is working with Computer Science Professor Jing Peng and several linguistics and computer science students to develop a language-independent method to automatically decide whether expressions like “stabbed in the back” or “blow the whistle” have either a literal or figurative interpretation in the text.

The team has been able to quantify many linguistic properties of idioms and incorporate them into their idiom detection algorithm.

“This work will contribute to the advancement of research in sentiment analysis, opinion mining, machine translation and natural language understanding,” Feldman says.

Secrets of successful start-up leadership

Following the lead of some of today’s most successful companies, entrepreneurs are increasingly forming new ventures as teams.

“Successful shared leadership at the top has been evidenced in many well-known organizations, such as HP’s Hewlett and Packard; Berkshire Hathaway’s Buffett and Munger; and ABB’s Barnevik and Lindahl,” says Business Management Professor Wencang Zhou.

In a recent study published in the International Entrepreneurship and Management Journal, Zhou found that a lead entrepreneur’s decision of who to include in a new venture team sets the stage for success – or failure.

While conventional wisdom suggests that a founding team’s combination of diverse educational backgrounds, experience and managerial skills can enhance creativity and performance, the reality is that successful shared leadership in founding teams depends more on the personalities than the expertise of team members. “New founding teams’ mean scores on conscientiousness and openness and diversity scores on extraversion were positively related to the amount of shared leadership, while diversity on openness was negatively related to shared leadership,” explains Zhou.

Zhou’s conclusions were based on results from a questionnaire administered to new venture founding teams in a technology incubator in China. “Data were gathered from 154 founding teams, consisting of 516 individual entrepreneurs,” Zhou says. “The web-based survey was translated into Chinese and back-translated into English by two independent bilinguals to ensure meaning equivalence across the two cultures.”

The bottom line? “The findings suggest entrepreneurial team founders should share leadership,” says Zhou. “That is, each team member should be willing and able to assume leadership roles when required. [Founders] can promote shared leadership by selecting team members who have a good fit in terms of personality traits.”
For the last few years, policymakers, educational leaders and corporate executives have warned that the United States is facing a STEM crisis. The fear is that with too few science, technology, engineering and math workers, the country is in danger of losing its competitive edge.

Secondary and Special Education Professor Jennifer Goeke, Montclair State’s Master of Arts in Teaching (MAT) program coordinator, has received $1.4 million in funding from the United States Department of Education to address that challenge.

Goeke is currently in the fourth year of her five-year project, “Restructuring Preservice Preparation for Innovative Special Education.” The project focuses on redesigning a strand of Montclair State’s Dual Certification MAT program to prepare middle and secondary school math and science teachers to teach in inclusive classrooms – to increase STEM achievement for all students, including those with disabilities.

“The idea is that if more math and science teachers are prepared to teach students with disabilities effectively, these students can be successful in STEM fields – instead of persisting in the mistaken belief that STEM subjects are ‘too demanding’ for them,” explains Goeke. “The United States needs more qualified STEM personnel. Students with disabilities may be well suited for STEM careers because of their day-to-day experiences of being resilient problem solvers. Many of them have talents in engineering, design, visual-spatial skills or even teamwork that are untapped in traditional math and science classrooms.”

Because of Goeke’s efforts, the new strand of the Dual Certification MAT program prepares teachers who will be dual certified in math or science and as Teachers of Students with Disabilities. The funding supports in-service teacher development, including special training for teachers in Bloomfield Middle School, the program’s partner school, who will mentor dual certification teacher candidates. “To date, we have done almost three full years of ongoing professional development with the mentor teachers including a weeklong Summer Institute every June,” notes Goeke.

Teacher candidates benefit from their relationships with mentor teachers. Before beginning their student teaching, Montclair State’s teacher candidates must complete a full semester of fieldwork in their mentor teachers’ classrooms. Each candidate has two mentor teachers – one a general education math or science teacher and their special education teacher. Together, they work to accelerate the skills of students who are not achieving at grade level.

So far, the program is a success with eight graduated teacher candidates. “By the end of the grant-funded project, we hope to graduate at least 20 candidates,” Goeke says. 

“Students with disabilities may be well suited for STEM careers because of their day-to-day experiences of being resilient problem solvers.”

– Jennifer Goeke

Building on a distinguished 106-year history, Montclair State University is proud to be a leading institution of higher education in New Jersey. The University’s six colleges and schools serve over 20,000 undergraduate and graduate students in more than 300 doctoral, master’s and baccalaureate-level programs. Situated on a beautiful, 250-acre suburban campus just 14 miles from New York City, Montclair State delivers the instructional and research resources of a large public university in a supportive, sophisticated and diverse academic environment.