



nysernet

2015

Annual Report



2015 ANNUAL
REPORT

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LETTER FROM THE PRESIDENT

Dear Colleagues,

I am pleased to present to you NYSERNet's 2015 Annual Report. Through more than three decades, NYSERNet's members have addressed the education and research community's networking and other technology needs together, with trust in each other guiding us through every transition.

This spring inaugurates more change, as we welcome a new president and I will step down from that position to focus on the research community's work and needs.

By itself, working with NYSERNet's extraordinary Board and staff to support

“These two ventures formed pieces in a puzzle that, when assembled, benefited all of New York and beyond.”

the collective missions of our members for the past 18 years has been a privilege beyond my imagining. Early on during those years, however, we committed to controlling the network down to the transport layer, focusing first on New York

City. The terrible attack of Sept. 11, 2001, complicated achievement of that goal, made it more essential, and taught a sobering lesson concerning the importance of communication and the need to harden the infrastructure that supports it. We invested in a wounded New York City, deploying fiber and building what today has become a global exchange point at 32 Avenue of the Americas. In the process, we forged partnerships that have proved deep and durable.

Despite inherent risks, and a perception that New York City institutions might principally benefit, NYSERNet's Board unanimously supported those efforts, and was similarly united in approving a statewide optical network that would seemingly benefit upstate primarily. These two ventures formed pieces in a



puzzle that, when assembled, benefited all of New York and beyond. It also enabled us to create new resources like the business continuity center in Syracuse, which worked flawlessly during Hurricane Sandy.

The fabric of trust we form together builds resources that support the ideas of our members. Discussion with the state office supporting research (NYSTAR), IBM and a broad swath of the community about cross-boundary problems like climate, energy, and health, evolved into the high-performance computing consortium. Our community is broadly engaged in genomics, climate and climate modeling, and in shortening the path from biomedical research to clinical practice. Many institutions in the NYSERNet community made seminal contributions to the LIGO project which, on Sept. 14, detected the first strong,

unmistakable signs of gravitational waves emanating from the merger of two black holes 1.3 billion years ago.

“I am honored to have been allowed to be part of this united effort.”

I am honored to have been allowed to be part of this united effort to which we have all committed, and I offer you my deepest thanks.

Regards,

Dr. Timothy Lance
President, NYSERNet Inc.

NYSERNet NAMES NEW PRESIDENT



Christopher M. Sedore named new president of NYSERNet

NYSERNet has named former Syracuse University vice president Christopher M. Sedore as its next president and CEO.

Sedore, who began his new role May 9, has served as the Senior Vice President for Enrollment Management at Syracuse University since May of 2014. He previously served as Syracuse's Associate Vice Chancellor for Academic Operations, and for six years before that as the university's Vice President for Information Technology and Chief Information Officer.

York state and beyond," Sedore said. "I look forward to working with our members, partners and supporters to advance research and education across New York."

NYSERNet conducted a national search that drew nearly 250 applicants from across the country and the optical networking community.

"I'm honored to join NYSERNet, a community that represents the leading edge of research and education in New York state and beyond"

Sedore has been a member of the NYSERNet Board of Directors since November 2008, and he succeeds Dr. Timothy Lance, who has served as NYSERNet's president since 1998.

"I'm honored to join NYSERNet, a community that represents the leading edge of research and education in New

"NYSERNet was successful in finding a terrific person to lead our organization," said John E. Kolb P.E., Vice President for Information Services and Technology and Chief Information Officer at Rensselaer

Polytechnic Institute. As chair of the NYSERNet.net Board, he led the NYSERNet Presidential Recruitment Committee.

"Chris brings the vision, understanding of higher education and research, analytical skills, and leadership experience to help NYSERNet with its next set of challenges."

Over the last three decades, NYSERNet has connected researchers and educators. With 85 institutional members using the advanced high speed research network, shared services, and special events as a collaboration platform, NYSERNet members and the state of New York have become leaders in the world of scientific discovery. “Dr. Tim Lance has led this effort admirably,” said Bill Thirsk, Vice President and Chief Information Officer at Marist College and Chair of the NYSERNet Board. “We are excited about NYSERNet’s next era and congratulate Chris on becoming our next president.”

Sedore comes to NYSERNet after more than 20 years at SU.

“For more than two decades, Chris has played key roles in moving Syracuse University forward,” said Interim SU Vice Chancellor and Provost Liz Liddy. “From creating a campus-wide research computing environment, to developing groundbreaking online degree programs, to raising the academic profile of Syracuse’s entering classes, Chris has made the university a better place. NYSERNet has made an outstanding choice and its board and staff will

benefit from Chris’s leadership.” Dr. Lance will continue at NYSERNet in a newly created role of Chief Research Officer. “I am delighted that Chris has taken on the president’s role,” said Lance, “and in many ways our interactions will be as in the past: trying to understand how best to serve our member institutions.”

“I am delighted that Chris has taken on the president’s role,” said Lance, “and in many ways our interactions will be as in the past: trying to understand how best to serve our member institutions.”

Lance continued, “As a long-serving member of the NYSERNet board, Chris knows well the NYSERNet community, and comes with a deep understanding of the challenges in both research and education that our institutions face. The NYSERNet community welcomes him in this new role.”



NYSERNET MEMBERS INSTITUTIONS

Albert Einstein College of Medicine		
Alfred University		
The American Museum of Natural History		
ARTstor		
Bank Street College of Education		
Binghamton University		
Brooklyn Law School		
Buffalo State College		
CANARIE		
Canisius College		
Capital Region BOCES/NERIC		
City University of New York		
Clarkson University		
Colgate University		
College of New Rochelle		
College of Saint Rose, The		
Columbia University		
Cornell University		
Corning Community College		
Daemen College		
DANTE		
D'Youville College		
Eastern Suffolk BOCES/ESRIC		
Erie #1 BOCES/WNYRIC		
Erie Community College		
Fordham University		
Frick Collection, The		
Genesee Community College		
Hofstra University		
IBM Watson Research Center		
Icahn School of Medicine at Mount Sinai		
Internet2		
	Ithaca College	
	Le Moyne College	
	Long Island University	
	Madison-Oneida BOCES	
	MAGPI	
	Manhattan College	
	Marist College	
	Massachusetts Institute of Technology	
	Monroe #1 BOCES / Monroe #1 RIC	
	Nazareth College	
	The New School	
	New York Genome Center	
	New York Presbyterian Hospital	
	New York State Department of Health: Wadsworth Center	
	New York State Education Department	
	New York University	
	NORDUnet	
	Nyack College	
	Onondaga-Cortland-Madison BOCES/CNYRIC	
	Rensselaer Polytechnic Institute	
	Rochester Institute of Technology	
	The Rockefeller University	
	Saint Bonaventure University	
	Saint John's University	
	Saint Joseph's College	
	Saint Lawrence University	
	SINET	
	Skidmore College	
	State University of New York: Central Administration	
		State University of New York: College of Environmental Science and Forestry
		State University of New York: Information Technology Exchange Center
		State University of New York: Upstate Medical University
		State University of New York at Alfred
		State University of New York at Geneseo
		State University of New York at Oneonta
		State University of New York at Oswego
		State University of New York at Potsdam Stony Brook Medicine
		Stony Brook University
		Syracuse University
		Teachers College, Columbia University
		TWAREN
		University at Albany
		University at Buffalo
		University of Rochester
		USLHCNet/CERN
		Vassar College
		Weill Medical College of Cornell University
		Weill Medical College of Cornell University in Qatar
		Yeshiva University

MEMBERSHIP UPDATE

Three new institutions joined NYSERNet in 2015, and more than a dozen existing members upgraded their connections to take advantage of network improvements.

Vassar College, in Poughkeepsie, joined the global research and education network community in order to speed collaboration with fellow researchers across the country and around the world. At the same time, Clarkson University joined as a Participating Tier 2 member

At Vassar, a liberal arts school with more than 2,450 students and 290 faculty members, researchers use the college's new 200-Mbps connection with NYSERNet to pursue high-performance computing options, including an NSF-sponsored partnership with the University of Buffalo. The network supports a variety of teaching and learning efforts, including student research in the sciences and humanities.

Throughout 2015, many NYSERNet member institutions increased their R&E bandwidth for researchers and academics. NYSERNet now offers bandwidth ranges of 50 to 200 Mbps, 201 Mbps to 2 Gbps, and 10 Gbps.

As a result, Marist College upgraded to 100 Mbps while Binghamton University, Hofstra University, the IBM Watson Research Lab, Monroe RIC, and WNYRIC upgraded their connections to 200 Mbps. Both City University of New York and the University at Buffalo upgraded their respective R&E connections to the maximum 10 Gbps. NYSERNet is in the process of upgrading its statewide backbone so that institutions can grow their connections to 100 Gbps when needed.

to take advantage of discounted commercial Internet service via The Quilt, and Saint Lawrence University joined to build a remote backup site in NYSERNet's collocation data center.



DATA CENTER

NYSErNet doubles capacity of high-performance Syracuse data center

Our members have long sought sound, offsite solutions that enhance their disaster recovery and business continuity strategies, and in 2015 we responded by opening our newly expanded 4,000-square-foot state-of-the-art data center in Syracuse.

Completed in January, the new data center effectively doubles the capacity of the original machine room we opened in 2006. That center could hold 53 cabinets; with the expansion, our capacity has grown to more than 100 cabinets.

The challenge wasn't just to secure space to expand, but to engineer a solution that could accommodate the larger and heavier equipment our members seek to deploy. By using a space adjacent to our Syracuse offices, yet physically separate from our original data center, we were able to install five tons of new steel girders, which underpin a raised-floor. That steel web transfers weight from our third-floor location to our building's very foundation, allowing us to accommodate more— and heavier—cabinets.

While located in a separate space less than 20 feet from the old, the new machine room relies on much of our existing power plant, monitoring, security and network infrastructure, which lowered the cost of construction and simplified ongoing operations.

Marist College in 2015 became the first member to take advantage of the expanded space, which can easily accommodate enterprise applications thanks to its n+1 infrastructure. The combination of a reliable data center and high-speed networking are precisely what our members asked us to provide, and we anticipate demand for the facility to grow in 2016.

VMWARE QUILT PROJECT

Regional networks collaborate to bring low-cost VMware service to their members

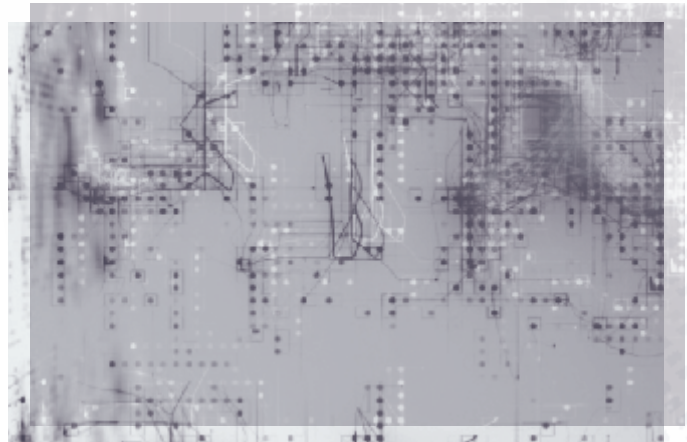
Educational institutions nationwide will soon have access to discounted VMware products and service—including all the company’s software, support, training and professional services—thanks to a new program led by NYSERNet and eight of The Quilt’s member networks.

The new program leverages the combined demand of the regional network member institutions to lower their VMware costs and speed adoption and implementation of money-saving virtualization technologies.

This VMware program is much like the long-standing collaboration among regional networks, or RONS, that provides lower-cost commercial Internet services to campuses. Since 2002, NYSERNet and its peer institutions have solicited RFPs for the bulk purchase of Internet services, an effort that enables our member institutions to purchase bandwidth for less than they would on the open market.

As a result of that effort—known as The Quilt—colleges, universities and research centers save money and keep up with the ever-increasing demand for bandwidth. At the same time, they can more easily acquire and maintain redundant Internet connections that increase network stability and availability.

That success led the team of representatives from a select group of the Quilt’s members—NYSERNet, Merit, MOREnet, NJEDGE, OSHEAN, OARnet,



MCNC, and WiscNet— to collaborate to solicit VMware proposals from prospective partners in August. Bids from the distributors were narrowed to two competitors in December. The group anticipates making a final selection on a VMware vendor in early 2016.

These collaborations are just two of examples of the value of leveraging the aggregate demand and knowledge of the regional networks. We’re looking forward to other ways to use our combined strength to help advance the interests of our member institutions.

WORKING GROUPS

NYSERNet expands working groups, continues to benefit from the value of members' ideas

For years, NYSERNet has convened professional working groups to help us and our members share knowledge and foster ideas, and in 2015 we formed three new groups to continue those efforts.

Each of the three new groups – disaster recovery/business continuity practices, research computing, and the future of campus-based data centers – consists of 10 to 15 senior IT representatives from our member institutions. In 2015, they each met six times via teleconference, and once at a November retreat at the University at Albany. The retreat attracted more than 50 participants, who developed group charters, selected leaders, and identified discussion topics for 2016.

During the year, the groups' members shared presentations on a range of topics, including updates on recent data center builds, disaster recovery and business continuity deployments that take advantage of NYSERNet's data center, and new models for supporting demand for research computing.

At its December meeting, NYSERNet's board sanctioned a fourth working group, the NYSERNet Security Working Group. By the end of the month, membership in the new group stood at 18, including many information security officers and chief information security officers.

We and our members have found that the power of the working groups lies in the guidance members provide to each other and to NYSERNet staff. As a result, the working groups have contributed significantly to NYSERNet's success over the years.

For example, NYSERNet's Data Center Working Group helped develop NYSERNet's data center by shaping requirements, design plans and service specifications, and evaluating potential site locations. The Dark Fiber Working Group served a similar role by helping NYSERNet develop its New York City dark fiber plant and global peering exchange.

NYSERNet's longest serving group, the Engineering Working Group, continues to meet every Monday afternoon to discuss issues related to the operation of our network infrastructure related topics of current interest. It sets the standard for longevity and purpose for all our working groups.

EDUCATION SERVICES

Education Services delivers a variety of training opportunities

NYSERNet continued to emphasize technical training, education and information-sharing in 2015, hosting hundreds of individuals from nearly 60 member institutions for conferences, workshops and training events.

Our two signature conferences—Tech Summit and NYSCIO—were well received last summer. The 25th annual Tech Summit was held in June at the University at Albany, attracting 78 attendees from 25 member institutions, and eight sponsors. The 14th annual NYSCIO, held for the third year in Skaneateles, attracted 78 participants from 56 institutions, and 11 sponsors.

In addition to these conferences, we helped our members take advantage of discounted training offered by new and existing NYSERNet partners.

In the spring, NYSERNet negotiated discount programs with New Horizons and Stormwind. The two leading IT-training companies offer hundreds of programs, from .NET programming to VoIP, at dozens of training sites across New York and around the country.

We also continued our partnership with the SANS Institute for group purchases of security training and certification.

NYSERNet staff engineers delivered five training sessions in 2015, including IPv6 classes held at New York University, the American Museum of Natural History,

and at Merit's offices in Ann Arbor, Mich. Two fiber workshops were held, including one at our Syracuse Training Center.

In addition to our own training, our new Syracuse Training Center enabled us to host vendor-run workshops. Juniper Networks offered two in-person training sessions that drew more than 24 individuals. Similar trainings already are planned for 2016.

In December, more than 50 people from 15 member institutions met at the University at Albany for our first Working Group Retreat. The individuals took part in three different working groups, which examined everything from research computing to the future of the data center. The meeting was the culmination of a year-long effort to encourage members to informally share information and collaborate. Meetings will continue in 2016 with another retreat planned next winter.

NYSERNet forms partnership with iGlass Networks

When it comes to managing network operations and solving problems for our members, NYSERNet has always relied on its in-house team of engineers.



Their experience and expertise is tough to beat, particularly when it comes to diagnosing outages, tracking network flaps, and staying in touch during emergencies.

Over the years, however, the nature and number of calls coming into our help desk—particularly after hours—has shifted from serious network-affecting outages to more routine requests, such as authorizing access to our New York City collocation facility or responding to outages that are more typically member-initiated maintenance activities.

At the same time, the number of NYSERNet services and participating institutions has increased, putting new stress on our small on-call team of senior engineers, who are available 24 hours a day, seven days a week.

In 2015, we looked for ways to reduce the demand on our engineering staff for the lower-order activities, while ensuring they had more time to focus on complex design and trouble-shooting tasks.

We did this in two ways. First, we modified our policies and procedures to encourage more self-service access to our New York City collocation facility (relying on technology to maintain the necessary security) and, second, by engaging a new partner to complement our support team.

That partner, iGlass Networks, is now responsible for processing many of the low-level support calls that once came directly to NYSERNet staff. iGlass offers fully managed network monitoring services, and now handles routine tasks, freeing our staff to focus on everything else.

As a result of this new relationship, we're able to maintain the high level of service our members expect and deserve, while increasing the amount of time our engineers spend improving our network, deploying new services and solving complex networking problems. We've also reduced the number of routine calls they handle by more than 75 percent.

In 2016, we plan to expand our relationship with iGlass to include more of our service catalog.



NETWORK

Research & Education Network continues to be at the heart of NYSERNet's business

In 2015, the NYSERNet Research and Education (R&E) network continued to serve as the core of our business, providing more capacity than ever before to our member campuses and the thousands of researchers and educators across the state that rely on it.

Demand on the network always increases, driven by the traditional big data disciplines like particle physics and astronomy. The Large Hadron Collider and the Laser Interferometer Gravitational-Wave Observatory (LIGO) both came back online in 2015 after upgrades that dramatically increased their ability to generate data and with the promise of exciting new discoveries, involving research teams around the world and at multiple NYSERNet member campuses.

But in 2015, the greatest surge in network use came from the growth of genome sequencing and analysis, with NYSERNet members consuming and creating enormous datasets, and offering them to the rest of the research world.

As with most networks, NYSERNet's R&E backbone consists of different layers: at the base, a pair of optical fibers; connecting to them, a dense wave-division multiplexing (DWDM) optical network; riding atop that, a set of high-speed Internet Protocol (IP) routers.

The network was built in late 2004 and early 2005, meaning that it just celebrated its tenth birthday. That's a very long time for any technology, and while we've been upgrading it throughout

the decade it was time for wholesale replacement of some of the equipment. The process started in late 2014 and continued through 2015 with three new Juniper EX9208 routers installed in New York City, Syracuse and Buffalo. Each router is capable of speeds ranging from 1 to 100 gigabits per second (Gbps) and in concert with optical equipment from Ekinops, we built a 100-Gbps backbone between the three cities with multiple 10-Gbps connections to upgraded routers in Rochester and Albany.

At the same time, our members were working on their own upgrades, so by the end of the year a dozen institutions connected at 10 Gbps. That's quite a leap in bandwidth, especially considering that the backbone ran at just 1 Gbps when it was built, and the largest campus connections topped out at a mere fifth that speed.

With that work completed, the NYSERNet board approved the next stage of upgrades: the replacement of the DWDM optical equipment. The new network, expected to be installed in the summer of 2016, will be capable of dozens of 100 Gbps connections, and will support the needs of the New York research community well into the next decade.



INTERNET SERVICES

NYSERNet members take greatest of The Quilt's Commercial Internet Service

NYSERNet member institutions in 2015 purchased nearly 100 gigabits of commercial Internet services through the collective purchasing power of The Quilt's Commercial Internet Service program—more bandwidth than any other regional network.

Some 45 NYSERNet member institutions—ranging from major university centers to liberal arts colleges, museums and BOCES—took part in the program last year.

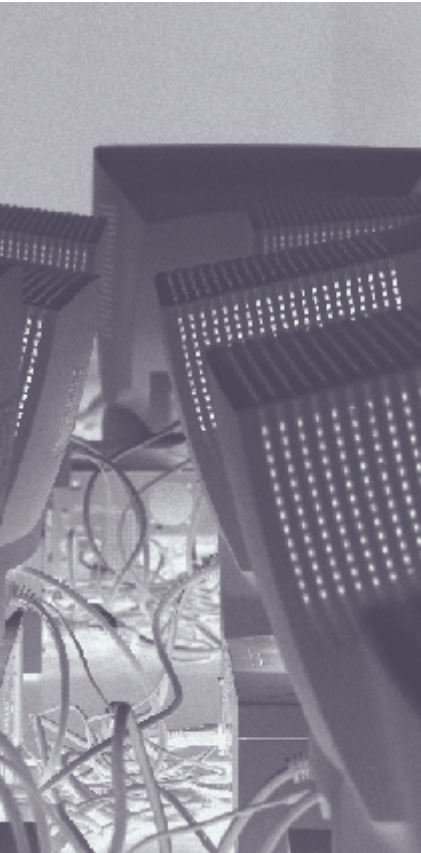
This year, NYSERNet is again part of the biennial service-provider bid review. Through an open RFP process, The Quilt and members like NYSERNet screen and qualify vendors who meet the community's requirements, and then negotiate favorable pricing for the member community.

Participation in The Quilt program saves members tens of thousands of dollars annually. On

average, they pay about 20 percent less for commercial Internet service than they would on the open market. At the same time, each time a NYSERNet member institution takes part in the program it adds bandwidth to the national aggregate, thereby enabling even lower cost-per-megabit pricing for the entire research and education community.

In the six years since NYSERNet has been part of The Quilt's Commercial Internet Service, it's enabled members to add bandwidth, higher performance, and greater reliability and security for the research and education community.

“Each time a NYSERNet member institution takes part in the program it adds bandwidth to the national aggregate.”



BOARD MEMBERS

Vijay Agarwala
Senior Director,
Research Computing
The New York
Genome Center

Michael Benedetto
Director of Information
Technology and Deputy CIO
Interim Chief
Information Officer
The American Museum of
Natural History

Brice Bible
Vice President and Chief
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University at Buffalo

Cole Campese
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Stony Brook University

Jeanne Casares
Chief Information Officer
Rochester Institute
of Technology

Brian T. Cohen
Vice Chancellor &
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Thomas Furlani
Director, Center for
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University at Buffalo

Armand Gazes
Director of Operations
and Networking
Rockefeller University

Christine Haile
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Robert Juckiewicz
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Hofstra University

John E. Kolb, P.E.
Vice President for
Information Services
and Technology and
Chief Information Officer
Rensselaer Polytechnic
Institute

Patricia Kovatch
Associate Dean for
Scientific Computing
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Timothy L. Lance
President
NYSERNet

Francis C. Lees
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Technology and Chief
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Justin Sipher
Vice President of Libraries
& Information Technology
St. Lawrence University

William Thirsk
Vice President
of Information
Technology/Chief
Information Officer
Marist College

R. David Vernon
Associate Chief
Information Officer
Cornell University

OUR STAFF

NYSERNet's Mission

NYSERNet is a private not-for-profit corporation created to foster science and education in New York state. Its mission is to advance network technology and related applications to satisfy needs common to the institutions that comprise New York's research and education community, and provide a forum for them to explore the opportunities and challenges of this innovative environment.

Leadership

Christopher M. Sedore
President and CEO

Stephen R. Kankus
Chief Operating Officer

William C. Owens
Chief Technology Officer

Mary C. Hyla
Chief Financial Officer

Timothy L. Lance
Chief Research Officer

Staff

Sharon Akkoul
Director, NYC Metro Fiber Services

Robert Bloom
Director, Data Center Services

Larry Gallery
Manager, Membership Development and K20 Program Manager

Jeffrey Harrington
Manager, Network Operations

Robin L. Jones
Human Resources Administrator and Contracts Coordinator

Katrina Lawrence
Accounting Specialist and Contracts Support

Christy Rohmer
Manager, Education Services

James A. Shaffer
Colocation Manager and Network Engineer


John S. Tonello
Director of Information Technology and Communications Manager

Elaine M. Verrastro
Office Services and Board Relations Assistant

Adam Wojtalewski
Senior Systems Administrator



THE HUMAN FACE OF RESEARCH



We live in an age of discovery to which members of the NYSERNet community have contributed mightily. Lithium ion batteries, the first pure anti-cancer vaccine (against human papillomavirus), seminal work on the CRISPR-Cas system (an immune response that bacteria and other microbes deploy against certain viruses, now used to precisely edit genes), discovery of two genes that together drive lethal forms of prostate cancer, better formulation of the mathematics of waves, from light to oceanic, explorations of the human genome in the context of the biome of flora within our bodies, and the study of gluons and quarks—all these derived from the fertile minds of New York researchers, often in collaboration with partners across the nation and globe.

They have worked on problems as varied as the nature of Type 1a supernovae, aridity in a warming planet, the stunning natural language capability of IBM's Watson, complications from flu, basic design and project management work at Brookhaven on the Atlas detector at CERN, and the search for Higgs boson, gravitational waves, and weakly interactive massive particles (WIMPS).

Leaders in these and other areas clearly possess astonishing talent, insight and

persistence. But many other human factors also contribute to scientific achievement. The creator of email (for ARPANET), who died recently at 75, offers a case in point. Ray Tomlinson was born in Amsterdam, N.Y., along the Mohawk River, grew up in the unincorporated town of Vail Mills, and was educated in the public schools of Broadalbin in rural upstate New York. His teachers must have seen a spark. He obtained a bachelor's of science in electrical engineering at RPI, where he participated in the co-op program with

Continues...

THE HUMAN FACE OF RESEARCH

IBM, then went on to MIT and work at what is now BBN Technologies. The tough decisions that universities, corporations, and agencies like NSF and NIH must constantly make are less about what to fund than whom. Tenure, often called a million-dollar (or more) decision, is granted to a person, not a research problem. As a community, we have worked to make available resources like high performance computing or specialized equipment such as sequencers, as well

“Tenure, often called a million-dollar (or more) decision, is granted to a person, not a research problem.”

as to support people who can help a research group use a new technical capability optimally, and the community helps itself, too. Institutions unaffected by Hurricane Sandy opened their doors to researchers whose labs and sensitive equipment had been destroyed. When flooding and power outages killed strains of laboratory animals developed over decades to study particular diseases and shared with colleagues, those researchers offered to return some of the offspring, facilitating the rapid rebuilding of colonies.

The extraordinary consequences thus far of the Human Genome Project (HGP) and recent discoveries using the Large Hadron Collider and Laser Interferometer Gravitational Wave Observatory (LIGO) give an idea of what can result when wise investments are made in talented people. During the 1990s, the United States invested about \$3 billion to determine the

sequence of base pairs in human DNA, with a later effort by Celera Corporation led by one of the researchers from HGP. More than 70 percent of the DNA studied came from an anonymous donor in Buffalo—Cold Spring Harbor Labs was one of the core sequencing sites—and some of the authors of the initial paper came from there and Albert Einstein School of Medicine. HGP grew out of work done in the early 1950s by James Watson and Francis Crick, who, with Maurice Wilkins, shared the 1962 Nobel Prize. Their work depended critically on the brilliant crystallographic work of Rosalind Franklin.

The Large Hadron Collider and LIGO stem from early 19th-century efforts to understand the nature of matter. In 2012, CERN announced that both the ATLAS and CMS detectors had found a particle consistent with what Peter Higgs had predicted in the 1960s as part of the Standard Model of the atom. And on Sept. 14, 2015, the newly refitted LIGO detectors at Hanford, Wash., and Livingston, La., detected chirps, stunning in their strength, essentially identical shapes, and promptness, and consistent with the gravitational waves from colliding black holes predicted by Einstein a century earlier. The new LIGO instruments had just been powered up, and either we were phenomenally lucky or these waves are far more frequent than many pessimistic predictions. How did this happen? Uncertain whether a gravitational wave could ever be sensed, very bright researchers nevertheless committed their careers to finding out. Though the initial LIGO instruments detected nothing, NSF funded creation of advanced LIGO instruments, and



“The new LIGO instruments had just been powered up, and either we were phenomenally lucky or these waves are far more frequent than many pessimistic predictions.”

House Science Committee Chair Rep. Sherwood Boehlert (of the Utica area) and Appropriations Chair Rep. James Walsh (of Syracuse) provided crucial leadership. The announcement paper has co-authors from Syracuse, Columbia, RIT, and Hobart and William Smith, and crucial early modeling was done at Cornell. Since HGP's completion, revolutionary instrumentation has slashed the cost of doing a genome to hundreds of dollars, a quantitative change so vast as to be

qualitative. The double helix unlocked meanings previously unknown; IBM's Watson can help manage the vast information generated by sequencing across a diverse tumor. With each advance we face new biological and ethical conundrums, however. LHC and LIGO have opened new windows on the universe with anticipated acceleration of discovery and, as with genetics, data growing at unimaginable rates.

We must take care to invest in people, in bright, tenacious, moral people.



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