

2017 – 2018 Annual Report



Table of Contents

About the Center.....	3
Flagship Programs.....	4
Research Initiatives.....	7
Core Members	11
Postdoctoral Researchers	12
Affiliated Personnel.....	13
Funding.....	15
Events.....	17
Publications.....	19
Presentations.....	22
Students Mentored.....	23
Other Notable Achievements.....	24
Web and Social Media Presence.....	25

About the Center

The Center for Advancing STEM Teaching, Learning & Evaluation (CASTLE) is a network of faculty, projects and programs engaged in scholarship surrounding STEM education. Key Focus Areas are:

- 1) **Discipline-based Education Research (DBER)** - The Science & Math Education Research Collaborative (SMERC) conducts rigorous discipline-based education research on issues involving postsecondary student learning, and members have a track record of peer-reviewed publications and external funding.
- 2) **Scholarship of Pedagogy** - CASTLE supports faculty efforts on pedagogical scholarship, evaluation and assessment, and fostering innovation in the classroom.
- 3) **Educational Transformation** - The Center promotes and fosters innovative curricula for national dissemination. The College of Science hosts several externally funded model curricula, including: LivePhoto, Interactive VideoVignettes, and a Learning Assistant Program which transforms traditional lecture format to small group active learning.
- 4) **Summer Math Applications in Science with Hands-on (SMASH) Experience** – This week-long summer program for rising eighth-grade girls concentrates on building girls’ confidence in science and math through an on-campus experience in and out of the lab. SMASH’s curriculum focuses on improving the two attitudinal values, perceived usefulness of mathematics and mathematical self-efficacy, impacting math-related achievement. Scholarship support makes it possible for Rochester City School students to participate when they otherwise would not be able to attend.
- 5) **Education and Careers of Groups Historically Excluded from the STEM Disciplines** – Beginning in June 2017, College of Science faculty, staff and students launched a five-year plan to foster a more inclusive environment across the College. The initiative, completing year one, has developed activities in three distinct areas: research mentoring, classroom practice and informal community (see page 4). Additionally, collaborations with Women in Science (WiSe), a CASTLE-affiliated program, continue to seek to engage women in the sciences and mathematics by offering information, equity and collaboration opportunities. The Center helps coordinate WiSe activities, and supports efforts to secure external funding through foundations and local and national industries.

The Center’s Mission is to:

improve science and math education and outreach initiatives at RIT and foster collaboration between science and math educators and education researchers.

The Center’s Vision is to:

- nurture a community of faculty, administrators, and staff interested in STEM education and pedagogy. CASTLE facilitates dialog about evidence-based practices, discipline-based education research, and methods of assessment and evaluation.
- establish a robust and sustainable infrastructure that transforms STEM educational practices, supports discipline-based education research, preparation, professional development, and outreach.
- foster innovations in education by integrating an interdisciplinary community of scholars; promoting, sustaining, and evaluating reform efforts; advocating for diversity and access; and influencing policy, fundraising, and public outreach.

Flagship Programs

Inclusive Excellence 5-Year Project

Beginning in June 2017, College of Science faculty, staff and students launched a five-year plan to foster a more inclusive environment across the College. Funded by a \$1M grant from the Howard Hughes Medical Institute the Inclusive Excellence initiative continues to develop activities in three distinct areas: **research mentoring, classroom practice and informal community**. The goal is a College in which all members, regardless of race, gender, sexuality or other identity, are valued and supported so as to realize their fullest potential.

Having completed year one, the project has made great strides in inclusivity training and continues to increase infrastructure, resources, and expertise to strengthen inclusion in STEM education. The initiative works toward embracing perspectives, strengths and insight from a multicultural base of faculty, staff and students in the natural sciences. Included in this population are transfer students and first-generation students.

Over the 5-year project timeframe, the goal is to engage 70 percent of College of Science faculty (including new hires), and a majority of students in project activities. Embarking on year two, project work has:

- *increased* awareness throughout the College.
- *gained* cohort participation of faculty, staff and students.
- *built* faculty mentor-student mentee relationships.
- *established* a strong foundation for faculty training.
- *introduced* metacognitive techniques in classroom teaching.
- *discussed* aspects of identity as a key component in a student's ability to learn.
- *identified* key elements to be addressed for stronger participation and understanding.
- *partnered* with Schools and Divisions on campus.
- *incorporated* Diversity Theater actors with impromptu enacted of personal shared stories.
- *began outreach* to media, web visitors and interested guest speakers.
- *developed* a reading group that discussed shared readings on race and other diversity topics.
- *conducted* baseline surveys indicating awareness within the College pertaining to a culture of inclusion.

Recognizing that multiple aspects are key to a successful student experience, faculty are working together on assuring a strong support network. That network is working toward an inclusive environment that encourages open and safe conversation and good listening and tools to understand themselves and others.

Widening the reach of understanding and participation in this initiative is a major goal over the next 4 years of the grant and beyond. Faculty, staff and students within each of the three focal areas (research, classroom and community) will now have mentors and past participants to shadow or offer guidance.

<http://InclusiveExcellence.rit.edu>

[Watch the video](#)

This program is supported in part by a grant to RIT from the Howard Hughes Medical Institute through the Science Education Program.

Learning Assistant (LA) Program

Dedicated to the transformation of STEM courses – the LA Program creates environments in which students can interact with one another, engage in collaborative problem solving and articulate and defend their ideas.

Undergraduate LAs facilitate small-group or other interactions in the classroom. RIT's model is designed to:

a) provide resources to help faculty implement pedagogical change in their classrooms, b) recruit and prepare talented STEM majors for teaching careers, c) engage faculty and departments in recruitment and preparation of future teachers and d) improve the quality of STEM education for all undergraduates.

During the Fall 2017 semester the program had 38 Learning Assistants working with 23 Faculty Mentors in four College of Science departments (Biological Sciences, Chemistry, Mathematics/Statistics and Physics) and two College of Engineering Technology departments (Manufacturing & Mechanical Engineering Technology, Electrical Engineering Technology). Last year's newly formed relationship with the American Sign Language and Interpreting Education department within NTID (National Institute for the Deaf) continued in 2017-18.

For the Spring semester there were 31 Learning Assistants working with 22 Faculty mentors within the same departments. Two Learning Assistants were placed in Interpreting courses mentored by NTID faculty (Interpeting II and Women and the Deaf Community).

Two recruitment fairs were held (fall and spring semesters) to educate students on the Learning Assistant Program and provide them an opportunity to speak with past and current LAs about their experiences. The LA Program also hosted two teacher roundtables, bringing teachers from local schools on campus to speak with students interested in the teaching career path.

Incorporating Metacognitive Research and Practice to Ensure Student Success (IMPRESS)

This program seeks to improve learning through direct instruction in metacognition, including accurate self-assessment and sense-making. It is an intensive educational experience for first-generation and deaf/hard-of-hearing students that incorporates metacognition scientific inquiry. IMPRESS consists of (1) a Summer Experience, (2) First Year Courses and (3) the LA Program. During the summer, IMPRESS students spend two weeks together investigating complex, real-world problems. During the first-year IMPRESS students take select metacognition courses, while second year students are eligible for Learning Assistant positions. Throughout the 2017-2018 academic year there were 86 IMPRESS students. This project is funded through National Science Foundation contract # DUE 1317450.

Summer Math Applications in Science with Hands-On (SMASH)

Experience for Girls

The SMASH Experience for Girls is a summer program designed to increase middle-school girls' engagement and interest in STEM. This unique program brings forty rising eighth grade girls to RIT's campus, to spend a week working on mathematical modeling projects, designed to show the usefulness of mathematics in everyday life; self-affirmation activities created to build confidence in math; and daily recreational activities, such as ice skating or a campus-wide STEM scavenger hunt. SMASH engages participants in mathematical modeling through a curriculum based on solving a crime scene involving activities in the College of Science's laboratories. The experience concludes with a hands-on event with representatives from local companies demonstrating to the girls the role of STEM in their industries, and a parent symposium where participants present a problem plaguing their local community and how mathematics could be used to solve this problem. In preparation for the summer experience, RIT undergraduate and graduate students, with interests in K-12 STEM education, under the mentorship of a local teacher create, test, and then facilitate all SMASH activities.

Professional-development for Emerging Education Researchers (PEER)

This discipline-based education research program holds the promise of satisfying expectations of both scholarship, which is increasing at teaching-centric institutions, and teaching effectiveness, a concern at all institutions. Additionally, junior education researchers seek more diverse training in research methods and theories. Emerging education researchers need support as they develop their research programs and expand their theoretical and methodological expertise, and they benefit from the guidance of knowledgeable peers and near-peers.

PEER-Rochester available projects include looking at the following questions:

- How do students collaborate within and among lab groups, and how does the nature of that collaboration change over the course of the summer experience? Network analysis is used to track collaboration within and among lab groups of 3-4 students.
- How do gender and ethnicity affect conversational equity in lab groups? Work is done in developing both quantitative and qualitative measures of equity, and comparing the measures among multiple groups.
- When former IMPRESS students return as learning assistants, how do their experiences in the program shape their interactions with students later on? The focus is on how learning assistant interactions with IMPRESS students change (or remain the same) as they move from participants to instructors.
- How does participation in the program affect student views of the nature of science and the role of experimentation? When students conduct experiments, researchers learn about ideas around what makes an experiment "good," and how table-top experiments are related to scientific practices.

World Location

Rochester, NY:	RIT IMPRESS Education Research Squad
Cologne, Germany:	Conducting Research in Active and Inclusive Pedagogies
Kibungo, Rwanda:	Big data analytics and Internet of things (IoT) in Education
Monterrey, Mexico:	Working groups for action research

Interdisciplinary STEM Education Research Forum

Beginning in February of 2018, CASTLE, along with College of Engineering Technology formed an interdisciplinary collaboration forum. STEM education research groups across campus meet to present, share ideas, and further common research goals. This strengthens the campus-wide STEM education research scholarship community by connecting education research faculty, forming new partnerships, and working together on research themes and interests. In the 2017-18 academic year, more than 40 individuals attended two forums (February 6 and April 24, 2018.) Four additional forums are planned for 2018-19.

Themes:

- conceptual understanding and conceptual change
- problem-solving and reasoning
- use of representations in STEM (including mathematics)
- instructional strategies and tools to improve learning
- science and engineering practices (argumentation, experimental design, etc.)
- self-regulated learning, metacognition, and affect
- workforce development, careers, career transitions, professional preparation
- inclusivity, access, diversity
- undergraduate research and co-op programs
- integrated computational methods in STEM disciplines
- ethical issues and social impact in STEM
- communication in STEM (oral, written, visual)
- informal STEM education

Research Initiatives

Science & Mathematics Education Research Collaborative (SMERC)

SMERC consists of a multidisciplinary group of Discipline Based Education Researchers (DBER), who study how students learn the STEM disciplines, apply science to problem solving, and become enculturated as scientists. This research advances fundamental knowledge of how people learn, and develops general theory that can be applied in practice. Dr. Dina Newman is the director of SMERC. The group meets twice weekly: once to discuss projects in progress, and once for a journal club where external research is discussed. The group also brings external speakers to campus approximately once a month. Individual projects by SMERC members include biology education, physics education, chemistry education, engineering education, and science/math communication. SMERC is the overarching team of researchers leading the following areas of research:

- I. Photonics and Optics Workforce Education Research (POWER)** is a project led by Dr. Ben Zwickl. POWER unites higher education, discipline-based education research, and workforce development in order to investigate core aspects of typical undergraduate STEM programs: scientific content, mathematics, and communication. This project is funded through a National Science Foundation Education & Human Resources Core Research (ECR) grant DGE-1432578. In the Photonics Careers Project, the early careers of technicians, engineers, and researchers are being studied to better understand the transition from school to jobs. With perspectives drawn from employees and managers, PhD students and their supervisors, researchers are identifying key math, physics, technical and communication skills that are essential for success. This foundational research supports stronger bridges between school and work and between the industry advocates for workforce development and the academic communities focused on education research. The Photonics Careers Project will provide additional research-based clarity that informs national discussion and policy around STEM workforce preparation.

II. Molecular Biology Education Group (MBER) is a collaborative research lab co-led by Dr. Dina Newman and Dr. Kate Wright, faculty in the Thomas H. Gosnell School of Life Sciences at RIT. The team studies how students think about molecular biology concepts and develops tools for improving biology education. Areas of Interest include:

- 1. Student mental models of molecular processes that involve DNA, and how novices differ from experts.** Much work has focused on student understanding of meiosis, which led to the development of a new framework, The DNA Triangle.
 - Wright LK*, Catavero CM, Newman DL*(2017). The DNA Triangle and its Application to Learning Meiosis. *CBE-Life Sci Educ.* 16(3):ar50, 1-14. doi:10.1187/cbe.17-03-0046. *These authors contributed equally.
 - Wright LK and Newman DL (July, 2018). High school teacher conceptions and lessons about meiosis reveal a critical gap in the biology curriculum. Oral presentation at the *Society for the Advancement of Biology Education Research 8th Annual Meeting*. Minneapolis, MN.
 - Dy GEC, Wright LK, and Newman DL (July, 2018). Visual Representations of Meiosis in Biology Textbooks Fail to Provide Important Conceptual Information. Poster presented at the *Society for the Advancement of Biology Education Research 8th Annual Meeting*. Minneapolis, MN.
- 2. How visual representations of molecular processes impact student understanding.** Prior work focused on the use of arrow symbols by experts and the interpretation of these symbols by learners. Current projects are examining how DNA is represented, on a continuum from the very concrete to the very abstract.
 - Wright LK, Cardenas JJ, Liang P, Newman DL (2018). Arrows in Biology: Lack of Clarity and Consistency Points to Confusion for Learners. *CBE-Life Sci Educ.* 17(1):ar6, 1-13. doi: 10.1187/cbe.17-04-0069.
 - Howard J, Wright LK and Newman DL (April, 2018). Conceptualizing Information Flow: from Concrete to Abstract. *26th Annual C-STEP Statewide Student Conference*. Bolton Landing, NY.
 - Cardenas JJ, Newman DL, Wright LK (November, 2017) Biology Figures: Pointing to Confusion for Learners. Oral presentation at the Rochester Academy of Sciences, Rochester, NY.
- 3. How physical models can be used to improve student learning about molecular processes.** This work is done in collaboration with the Center for Biomolecular Modeling at the Milwaukee School of Engineering, where many 3-D models have been developed. These models provide the basis for activities that promote deep conceptual learning of processes that are not easy to observe directly.
 - Newman DL, Stefkovich M, Clasen C, Franzen M, and Wright LK (2018). Physical Models can provide superior learning opportunities beyond the benefits of active engagement. *Biochem Mol Biol Educ.* 46(5): 435-444. doi: 10.1002/bmb.21159
- 4. Development of assessments and activities for undergraduate instructors teaching molecular biology concepts.** Numerous activities have been developed based on research into student thinking of biology, many of which demonstrably improve learning for undergraduates at all levels. Research-based assessments are also developed, such as the Central Dogma Concept Inventory (CDCI), which can be used to assess student understanding of Central Dogma processes.
 - Newman DL, Wright LK (2017). Meiosis: A Play in Three Acts Starring DNA Sequence. *CourseSource* Vol 04. DOI: [10.24918/cs.2017.9](https://doi.org/10.24918/cs.2017.9)
 - Donahue CJ*, Adair AA*, Wright LK and Newman DL (2018). A Close-up Look at PCR. *CourseSource. In Press.* *These authors contributed equally.

- Newman DL and Wright LK (July, 2018). How to Get More Out of Conceptual Assessments. Oral presentation at the *Society for the Advancement of Biology Education Research 8th Annual Meeting*. Minneapolis, MN.
- Adair AA, Donahue CJ, Newman DL, Wright LK (November, 2017) A New Model for PCR Instruction. Rochester Academy of Sciences, Rochester, NY.

5. **Interactive video vignettes for teaching key ideas that are difficult for students.** A suite of interactive, web-based activities have been developed to introduce or clarify key concepts and big ideas in biology. This project is funded by NSF (DUE-1432286, DUE-1432303) and involves a collaboration with Dr. Robert Teese (School of Physics and Astronomy at RIT) and Dr. Jean Cardinale (Alfred University).

- 14 IVVs have been developed, 12 of which are currently available for classroom use. The IVVs are included in a set of freely available Modules for INteractive Teaching (MINTs) see <https://ivv.rit.edu/MINT>
- Rynkiewicz P, Newman DL, Wright LK (November, 2017) Producing Interactive Video Vignettes: An Online, Live-Action Based Approach to Supplemental Learning. Poster presented at the Rochester Academy of Sciences, Rochester, NY.
- Newman DL, Wright LK, Cardinale JA (October, 2017) An interactive video vignette successfully teaches pedigree analysis to undergraduates. Poster presented at the American Society of Human Genetics, Orlando, FL.

III. Research Experience for Undergraduates (REU) is a program that brings students from all over the U.S. to learn about DBER and undertake cutting edge projects in the field (<https://www.rit.edu/science/smerc/reu>). SMERC members Kate Wright (PI) and Dina Newman (Co-PI) successfully obtained funding to run a second iteration of the NSF funded REU program: **Research Experiences for Undergraduates in Model-based Reasoning in STEM Education at the Rochester Institute of Technology** (DUE 1757477). The team will begin soliciting applications during Fall 2018 for the summer 2019 cohort.

Papers with REU student authors published in the past year include:

- Newman DL, Stefkovich M, Clasen C, Franzen M, and Wright LK (2018). Physical Models can provide superior learning opportunities beyond the benefits of active engagement. *Biochem Mol Biol Educ*. doi: 10.1002/bmb.21159
- Wright LK, Cardenas JJ, Liang P, Newman DL (2018). Arrows in Biology: Lack of Clarity and Consistency Points to Confusion for Learners. *CBE-Life Sci Educ*. 17(1):ar6, 1-13. doi: 10.1187/cbe.17-04-0069.

Remaining funds from the previous REU program that ran during the summers of 2015-2017 (DUE 1359262) were used to fund three research students: former REU cohort member Grace Elizabeth Dy (mentors Kate Wright and Dina Newman), former REU cohort member Alexandria Cervantes (mentor Kelly Martin), and an RIT undergraduate student, Jessica Nelson (mentor Kelly Martin) for summer research work. In addition to the ongoing research, several former REU students have been able to present work at National Meetings. In the past year

- Grace Elizabeth Dy presented her work at the 8th annual Society for the Advancement of Biology Education Research (SABER) National meeting in Minneapolis, MN.
- Former REU cohort member Jessica Hathaway (mentor Ben Zwickl) presented her past work at the American Association for Physics Teachers (AAPT) summer meeting in Washington DC.

IV. Graduate Admission and Retention Research

In January, 2018, work began on research studying holistic practices to increase diversity and retention in physics graduate programs. The team includes Dr. Casey Miller, Dr. Ben Zwickl, Dr. Scott Franklin, and post-doc Dr. Lindsay Owens. They are studying current admission and retention across the United States, and offer targeted interventions and tools to aid programs in using more holistic measures. The goal of this project is to increase access to, and retention of, women and excluded identity groups in graduate physics programs.

Non-Cognitive Assessment

We have begun pilot testing of the Non-Cognitive Assessment to establish validity and reliability of the instrument. The NCA has been sent to four institutions, including the three partner institutions, and we currently have data from 95 graduate student participants.

Interview Results

Over the past year, interviews were conducted with 17 faculty members and focus groups were conducted with 21 graduate students from three partner institutions. The goal of these interviews was to determine faculty and student attitudes towards a variety of recruitment, admissions, and retention practices. Qualitative results from these interviews have been presented at the American Association of Physics Teachers in July 2018 Conference as well as the Physics Education Research Conference in August 2018. Finally, these results have been sent for publication and are currently under review as part of the PERC Proceedings.

Presence of Homophily Within and Across Physics Departments

Data regarding educational pathways were collected from 6,104 permanent faculty from 230 physics departments (e.g., physics, astronomy, astrophysics, and applied physics). There is a disproportional representation of faculty among all physics departments whose educational background included an elite institution. Approximately 33% of all physics faculty received their Ph.D. from an elite institution, even though these institutions only produce around 18% of physics Ph.D.'s each year.

This project is funded by NSF-NRT 1633275.

CASTLE Center Core Members—Managing CASTLE Programs & Projects



Jennifer Bailey
Senior Lecturer, Kate Gleason
College of Engineering



Casey Miller
Associate Dean for Industrial
Partnerships and
Associate Professor, School of
Chemistry & Material Sciences



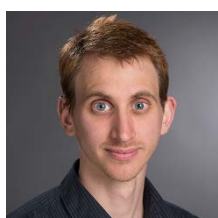
Scott Franklin
Director, CASTLE and
Professor, School of
Physics and Astronomy



Dina Newman
Director, SMERC and
Associate Professor, Thomas H.
Gosnell School of Life Sciences



Thomas Kim
Associate School Head and
Associate Professor, School of
Chemistry & Materials Science



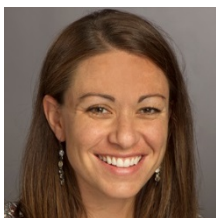
Corey Ptak
Program Coordinator, LA
Program and Lecturer,
Thomas H. Gosnell School of
Life Sciences



Kara Maki
Associate Professor, School of
Mathematical Sciences



Leslie Kate Wright
Associate Professor, Thomas
H. Gosnell School of
Life Sciences



Kelly Norris Martin
Assistant Professor, Thomas H.
Gosnell School of Life Sciences



Benjamin Zwickl
Assistant Professor, School of
Physics and Astronomy

CASTLE Postdoctoral Researchers



Anne Leak
Postdoctoral Researcher
School of Physics
and Astronomy



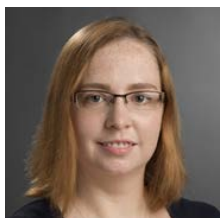
Susan Rothwell
Postdoctoral Researcher
School of Physics
and Astronomy



Rita Margarita Almeida Magalhaes
Postdoctoral Researcher
RIT Inclusive Excellence
Center for Advancing STEM
Teaching, Learning & Evaluation



Brittney Wyatt
Postdoctoral Researcher
RIT Inclusive Excellence
Center for Advancing STEM
Teaching, Learning & Evaluation



Lindsay Owens
Postdoctoral Researcher
School of Chemistry and
Material Sciences

CASTLE Affiliated Personnel—Contributing to CASTLE Programs & Projects



Linda Barton
Associate Professor, School of
Physics and Astronomy



Christina Goudreau Collison
Associate Professor, School of
Chemistry & Materials Science



Adwoa Boateng
COS Library Liaison, Research
and Instruction Services



Jennifer Connelly
Lecturer, School of
Physics and Astronomy



Yeliz Celik
Visiting Lecturer, School of
Physics and Astronomy



Paul Craig
School Head and
Professor, School of Chemistry
& Materials Science



Michelle Chabot
Senior Lecturer, School of
Physics and Astronomy



Tina Chapman DaCosta
Director of Diversity Theatre
Office for Diversity and
Inclusion



Elizabeth Cherry
Associate Professor, School of
Mathematical Sciences



Elizabeth Hane
Associate Professor, Thomas H.
Gosnell School of Life Sciences
Associate Head of the Thomas H.
Gosnell School of Life Sciences



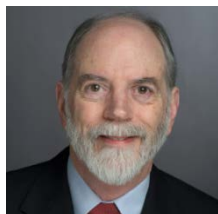
Jeremy Cody
Associate School Head and
Associate Professor, School of
Chemistry & Materials Science



Lea Vacca Michel
Associate Professor, School of
Chemistry & Materials Science

CASTLE Affiliated Personnel (Continued)

Contributing to CASTLE Programs & Projects



Robert Teese
Assistant Professor, School of
Physics and Astronomy



Paul Wenger
Associate Professor, School of
Mathematical Sciences



Anne Young
Professor Emerita, School of
Physics and Astronomy

During the 2017 – 2018 academic year CASTLE has led or collaborated on seventeen different grants that total more than \$6.0 million. Center funding has risen dramatically over the past five years.

Current CASTLE Funding

Dates	Total Funding	Funding Details	Personnel
6/2013-8/2019	\$899,907	Metacognition: A Transformative Approach to Retaining Deaf/HoH and first generation STEM Majors; NSF-National Science Foundation	PI Scott Franklin, Co-PI Elizabeth Hane
7/2013-6/2017	\$199,980	Collaborative Research: Transforming the Organic Chemistry Experience: Development, Implementation and Evaluation of Studio-Based Modules; NSF-National Science Foundation	PI Christina Goudreau, Co-PI Thomas Kim
9/2014-8/2018	\$399,309	Transfer of Math, Physics, and Communication Skills Into the Entry-level Photonics Workforce; NSF-National Science Foundation	PI Benjamin Zwickl, Co-PI Kelly Norris Martin
9/2014-8/2018	\$372,580	Collaborative Research: Development and Assessment of Interactive Video Vignette Modules for Biology Teaching; NSF-National Science Foundation	PI Robert Teese, Co-PIs Leslie Kate Wright and Dina Newman
9/2014-8/2018	\$133,868	Collaborative Research: Undergraduate Students' Epistemology and Expectations of Experimental Physics; NSF-National Science Foundation	PI Benjamin Zwickl
10/2014-9/2018	\$339,825	REU Site: Model-Based Reasoning and Representations in STEM Learning at the Rochester Institute of Technology; NSF-National Science Foundation	PI Leslie Kate Wright, Co-PI Dina Newman
5/2015-4/2020	\$615,969	CPS: Frontier: Collaborative Research: Compositional, Approximate, and Quantitative reasoning for Medical Cyber-Physical Systems	PI Elizabeth Cherry
6/2015-6/2018	\$111,002	Collaborative Research: Role of Undergraduate Biochemistry Education in Protein Function Assignment; NSF-National Science Foundation	PI Paul Craig, Co-PI Herbert Bernstein
9/2015-8/2018	\$270,225	The Access Network: Supporting Retention and Representation in Physics through an Alliance of Campus-Based Diversity Programs; NSF-National Science Foundation	PI Scott Franklin
5/2016-5/2020	\$649,626	Collaborative Research: Exploring factors that shape education and workplace training on essential 21 st Century Competencies: A translational study in	PI Benjamin Zwickl, Co-PI Kelly Norris Martin

		Four High-STEM Job Regions; NSF-National Science Foundation	
9/2016-8/2019	\$419,284	Collaborative Research: Transforming the Organic Chemistry Lab Experience: Implementation and Evaluation of a Reformed Organic Lab Curriculum Across Institutions; NSF-National Science Foundation	PI Christina Collison, Co-PIs Dina Newman, Thomas Kim
9/2016-8/2019	\$299,982	Collaborative Transformation through Faculty Triads; NSF-National Science Foundation	PI Scott Franklin, Co-PI Sophia Maggelakis
9/2016-8/2019	\$428,022	Collaborative Research: NRT-IGE: Deploying Holistic Admissions and Critical Support Structures to Increase Diversity and Retention of US Citizens in Physics Graduate Programs; NSF-National Science Foundation	PI Casey Miller, Co-PIs Ben Zwickl, Scott Franklin
9/2016-8/2019	\$73,740	Collaborative Research: The PIPELINE Network; NSF-National Science Foundation	PI Linda Barton, Co-PI Ben Zwickl
10/2016-9/2018	\$18,072	NSF Includes: A National Network for Access and Inclusion in Physics Graduate Education; NSF-National Science Foundation / APS-American Physics Society	PI Casey Miller
1/2017-4/18	\$99,680	Integrated Photonics Workforce Needs Assessment for New York State; DOD – Department of Defense	PI Ben Zwickl, Co-PIs Anne Leak, Kelly Martin
7/2017-6/2020	\$253,052	Collaborative Research: Data Integration in Undergraduate Mathematics Education; NSF-National Science Foundation	PI Paul Wenger, Co-PIs Matthew Hoffman, Carl Lutzer
9/2017-8/2022	\$1,000,000	HHMI USE Inclusive Excellence 2017; HHMI-Howard Hughes Medical Institute	PI Scott Franklin, Co-PIs Jennifer Connelly, Elizabeth Hane, Lea Michel, Dina Newman
9/2017-8/2020	\$97,372	Collaborative Research: Using protein function prediction to promote hypothesis-driven thinking in undergraduate biochemistry education; NSF-National Science Foundation	PI Paul Craig, Co-PIs Herbert Bernstein, Jeffery Mills, Suzanne O’Handley
8/2018-7/2021	\$234,989	Collaborative Research: Developing a quantitative three-dimensional understanding of cardiac arrhythmias	PI Elizabeth Cherry, Co-PI Matthew Hoffman
9/2018-8/2021	\$134,491	Collaborative Research: Expanding Access: Furthering a network of diversity-focused programs in the physical sciences	PI Scott Franklin
10/2018-9/2021	\$290,104	Collab: Interactive Video-Enhanced tutorials on problem solving in Physics	PI Robert Teese, Co-PI Michelle Chabot
9/2018-8/2023	\$115,714	Collaborative Research: NSF Includes Alliance Graduate Education Network	PI Casey Miller

CASTLE Center Events

1. The 5th Annual CASTLE Symposium

The 5th annual CASTLE Symposium was held on Wednesday, May 9, 2018 in the Center for Integrated Manufacturing Studies (CIMS Conference Room). The symposium began with a poster session that showcased more than 40 student and faculty research projects focused on improving STEM education. Provost Jeremy Haefner and College of Science Associate Dean Casey Miller provided opening remarks, followed by remarks by Associate Professor Dina Newman about the Science and Mathematical Educational Research Collaborative (SMERC). An award ceremony followed honoring recipients of the 4th “Science and Math Education Research Special Honor Award” and recognition of the 2016 – 2017 academic year Undergraduate Learning Assistants.

- a. 2018 Science and Math Education Research Special Honor Award Recipients
 - i. Dean Sophia Maggelakis
 - ii. Associate Provost Ryne P. Raffaele
 - iii. Provost Jeremy Haefner
 - iv. Jordan Cardenas

- b. 2017 – 2018 Undergraduate Learning Assistants:
Effiba Armah, Diksha Biswa, Nicholas Blachowicz, Brandon Bogner, Dylan Booth, Sam Cammarata, Jordan Cardenas, Regina Chartier, Devon Christman, Caty Cortez, Erica Delles, Cayla Denning, Isaac Deppen, Nicole Eng, Andrew Fleischer, Emely Giraldo, Maryah Glover, Nadia Gunderson, Miranda Hebert, Gretchen Horst, Jessie Howard, Loryn Johnson, Arthur Kalb, Debrah Kamau, Jeremy Kane, Rachel Kane, Andre Lebron, Spenser Lionetti, Katie Luedders, Kishoth Manoranjithan, Bryanne McDonough, Liam Megraw, Renee Meinhold, Amanda Michels, Olivier Montmayeur, Andres Mora, Alana Moraes, Janessa Morelli, Jacob Palmerio, Nicole Pannullo, Trevor Penix, Sean Peterson, Gregory Nero, Natasha Nigam, Harold Pineda, Jacob Poirier, Hailey Richmond-Boudewyns, Kory Schimmelpfennig, Britta Schwall, Jessica Shane, Nicklas Smith, KayLee Steiner, Zach Sutherby, Christopher Webster, Amanda Weiss, Haley Wiskoski, Albek Yegemberdin, Zaima Zeniya

2017 – 2018 Learning Assistant Mentors:

Marge Carrillo, Karl Korfmacher, Nate Barlow, Kate Wright, Mike Cromer, Mark Olles, Alla Bailey Joe Lanzafame, Daniel Maffia, Dina Newman, Dawn Carter, Bernadette Lanciaux, Liz Bremer, Greg Babbitt, Scott Franklin, Elizabeth Hane, Michelle Chabot, Charlie Lusignan, Sheth Nyibule, Brain Koberlein, Shola Olabisi, Steven Ciccarelli, Amanda Bao, Abdullah Faruque, Corey Ptak, Jeyhan Kartaltepe, Rob Szalapski, Louis McLane, Aaron McGowan, George Thurston, Deirdre Schlehofer, Connie Fitch, Deana Olles.

2. CASTLE/SMERC Seminar Speakers

- a. Mac Stetzer, University of Maine, May 22-23, 2018, 11am-12pm—"Investigating the Nature of Student Reasoning in Physics: New Methodologies."
- b. Kristina Mitchell, Texas Tech University, April 22-24, 2018, 12:20pm-1:15pm—"Gender Bias in Student Evaluations."
- c. Kimberly Linenberger Cortes, Kennesaw State University, April 17-18, 2018, 1:25pm – 2:20pm—"Using Neurophysiological Techniques to Investigate Students' Processing of Representations and 3D Models in Biochemistry."
- d. Melissa Dancy, University of Colorado, Boulder, March 27-28, 2018, 3:30pm-4:30pm—"STEM Students' Awareness of Racism and Sexism."
- e. Rebecca Lindell, Tiliadal STEM Education Solutions, Lafayette, IN, March 20-22, 2018, 11:15am-12:10pm—"The Need for Guidelines and Standards for the Use and Development of STEM Concept Inventories."
- f. Marcia Gail Headley, University of Delaware, January 23-24, 2018, 1:25pm-2:20pm—"How Do Adolescents Read Mathematical Text?: An investigation of the complexity of symbolic mathematics language literacy."
- g. Matt Ohland, Purdue University, November 28-29, 2017, 1:25pm-2:20pm—"Forming and Managing Student Teams."
- h. Kimberly Tanner, San Francisco State University, September 19-21, 2017. (9/20) 1:25pm-2:20pm—Seminar: "What Does Teaching Sound Like? Introducing DART—Decibel Analysis for Research Teaching—A New Tool for Systematically Analyzing Teaching Practices Across Instructors and Institutions," and (9/21) 1:30pm-3:00pm—Workshop: "Moving Towards Active Learning, Both Inside and Outside of Class Time"

3. Learning Assistant Program Fall/Spring Recruitment Fairs

The LA Program hosted two recruitment fairs, one in the Fall semester (October 20) and one in the Spring semester (March 2), which were great opportunities for interested students. The recruitment fairs started with a presentation by the Program Director, Scott Franklin, and Program Manager, Corey Ptak, providing more details on the program, including expectations and commitments. After the Q & A session a student panel of current learning assistants spoke about their experiences and the benefits of the program. Students were then encouraged to visit with a faculty mentor from the department for which they are interested in being an LA.

Interdisciplinary STEM Education Research Micro-Summits

The first micro-summit focusing on cross-campus sharing of STEM education research was held at RIT on February 6, 2018. It was organized and led by faculty Dina Newman, Ben Zwickl, and Scott Franklin, Director of the Center for Advancing STEM Teaching, Learning & Evaluation (CASTLE). They partnered with Associate Dean Mike Eastman of the College of Engineering Technology, put together a committee, who in turn invited interested RIT faculty and post-docs to attend. The micro-summit included short presentations introducing work being done in various areas of STEM education research, followed by an interactive exercise to determine intersections in discipline-based education research currently being done, as well as common interests for future research.

An additional *forum* (as it was decided to be called) was held on April 24, and included presenters from National Technical Institute for the Deaf (NTID), B. Thomas Golisano College of Computing and

Information Sciences (GCCIS), and College of Engineering Technology (CET). Plans were put into place to expand participation by inviting additional RIT Colleges.

The forums are hosted by CASTLE in association with the following: B. Thomas Golisano College of Computing & Information Sciences, College of Engineering Technology, College of Health Sciences and Technology, College of Liberal Arts, College of Science, and Kate Gleason College of Engineering. Regular committee meetings were put into place, organizing forums to continue throughout the coming semesters, building on collaboration and sharing of ideas and grant submissions.

Publications

The CASTLE Center had 40 publications between 6 faculty members during the 2017-2018 academic year.

Donahue, CJ*, Adair, AA*, **Wright, LK** and **Newman, DL** (2018). A Close-up Look at PCR. CourseSource. In Press. *These authors contributed equally.

Newman, DL, Stefkovich, M, Clasen, C, Franzen, M, and **Wright, LK** (2018). Physical Models can provide superior learning opportunities beyond the benefits of active engagement. *Biochem Mol Biol Educ*. 46(5): 435-444. doi: 10.1002/bmb.21159

Pelaez, N, Anderson, TR, Gardner, SM, Yin, Y, Abraham, JK, Bartlett, EL, Gormally, C, Hurney, C, Long, TM, **Newman, DL**, Sirum K, Stevens, MT (2018). A community-building framework for collaborative research coordination across the education and biology research disciplines. *CBE-Life Sci Educ*. 17(2):es2, 1-10. doi.org/10.1187/cbe.17-04-0060

Wright, LK, Cardenas, JJ, Liang, P, **Newman, DL** (2018). Arrows in Biology: Lack of Clarity and Consistency Points to Confusion for Learners. *CBE-Life Sci Educ*. 17(1):ar6, 1-13. doi: 10.1187/cbe.17-04-0069.

Wright, LK, Catavero, CM, **Newman, DL***(2017). The DNA Triangle and its Application to Learning Meiosis. *CBE-Life Sci Educ*. 16(3):ar50, 1-14. doi:10.1187/cbe.17-03-0046. *These authors contributed equally.

Pelaez, N, Anderson, T, Gardner, SM, Yin, Y, Abraham, JK, Bartlett, E, Gormally, C, Hill, JP, Hoover, M, Hurney, C, Long, T, **Newman, DL**, Sirum, K, Stevens M (2017). The Basic Competencies of Biological Experimentation: Concept-Skill Statements. PIBERG Instructional Innovation Materials. Paper 4. <http://docs.lib.purdue.edu/pibergiim/4>

Newman, DL, **Wright, LK** (2017). Meiosis: A Play in Three Acts Starring DNA Sequence. CourseSource Vol 04. DOI: [10.24918/cs.2017.9](https://doi.org/10.24918/cs.2017.9)

Archibeque, Ben; Genz, Florian; Franklin, Maxwell; **Franklin, Scott**; Sayre, Eleanor, Quantitative Measures of Equity in Small Groups, Proceedings of the 2017 Physics Education Research Conference, PERC, pp. -, Cincinnati, Ohio, United States (August 2017)

Pomiank Katarzyna; Zwolakk Justyna; Sayrek Eleanor; **Franklin, Scott**; Kustus, Mary Bridget, Using Social Network Analysis on classroom video data, Proceedings of the 2017 Physics Education Research Conference, PERC 2017, pp. -, Cincinnati, Ohio, United States (August 2017)

Franklin, Scott, Sayre, Eleanor and Kustus, Mary Bridget. Professional Development for Emerging Education Researchers: Two Models for Field Schools, 2018 The Collaborative Network for Engineering and Computing Diversity (CoNECD), pp. -, Washington, District of Columbia, United States (April 21, 2018)

Franklin, Scott V., Matheson, Amanda and Wood, Laura. Guided and Unguided Student Reflections, 2017 Physics Education Research Conference , Physics Education Research Conference, pp. -, Cincinnati, Ohio, United States (October 2017)

Henderson, Charles, Connolly, Mark, Dolan ,Erin L , Finkelstein, Noah, **Franklin, Scott**, Malcom, Shirley, Rasmussen ,Chris, Redd, Kacy, St John, Kristen, Towards the STEM DBER alliance: Why we need a discipline-based STEM education research community, International Journal of STEM Education (Dec 2017)

Donahue, Callie J., Adair, Ashley A., **Wright, L. Kate** and **Newman, Dina L.** A Close-up Look at PCR. (2018). CourseSource. Accepted for publication.

Newman, Dina, Stefkovich, Megan, Clasen, Catherine, Franzen, Margaret and **Wright, L. Kate**. Physical Models can provide superior learning opportunities beyond the benefits of active engagement. (2018). Biochemistry and Molecular Biology Education. In press.

Wright, L. Kate, Cardenas*, J, Liang, P, **Newman, Dina L.** Arrows in Biology: Lack of Clarity and Consistency Points to Confusion for Learners. (2018). CBE Life Sciences Education. Vol 17(1),1-13.

Wright, L. Kate, Catavero, Christina M, Newman, Dina L. The DNA Triangle and it's Application to Learning Meiosis. (2017). CBE Life Sciences Education. Vol 16(3), 1-14.

Newman, Dina L, and **Wright, L. Kate**. Meiosis: A Play in Three Acts, Starring DNA Sequence. (2017). CourseSource. Volume 4, 1-9.

Hu, Dehui, Chen, Kingston, Young, Nicholas, Young, Leak, Anne E, **Zwickl, Benjamin** Characterizing mathematical problem-solving in physics academic research and industry using epistemic games, , Physical Review Physics Education Research (revise and resubmit)

Leak, Anne E, Reiter, Erik, Santos, Zackary, **Norris Martin, Kelly**, and **Zwickl, Benjamin M**, Meaningful Science and Engineering Practices: Contextualizing NGSS Practices to Reflect Authentic Use and Support Student Learning Science Education (revise and resubmit)

Norris Martin, Kelly, Gaffney, Amy L, Leak, Anne E, Nelson, Jes, Cervantes, Alexandria T. Gardener, Katherine Louise, Clark, Brandon L., and **Zwickl, Benjamin M.** Spewing nonsense [or not]: communication competence and socialization in optics and photonics workplaces, Communication Education, **67**, 414-437 (2018)

Miller, Casey W., **Zwickl, Benjamin M.**, Posselt, Julie R., Silvestrini, Rachel T , Hodapp, Theodore. Typical Physics PhD Admissions Criteria Limit Access to Underrepresented Groups but Fail to Predict Doctoral Completion. Science Advances (under second round review).

Winans, Kirk, **Martin, Kelly N.**, Leak, Anne E., Raghuraman, Anita, **Zwickl, Benjamin M.**, The skills gap discourse in academia: A meta-analysis of the conversation through research database articles Under review

Leak, Anne, Santos, Zackary, Reiter, Erik, **Zwickl, Benjamin, Martin, Kelly**, Hidden factors that influence success in the optics workforce. Physical Review PER, **14**, 010136 (2018)

Hu, Dehui, **Zwickl, Benjamin**, Examining students' views about validity of experiments: from introductory to Ph.D. students. Physical Review PER, **14**, 010121 (2018)

- Hu, Dehui, Zwickl, **Benjamin M.**, Wilcox, Bethany R., and lewandowski, H. J., Qualitative investigation of students' views about experimental physics. *Phys. Rev. Phys. Educ. Res.* **13**, 020134 (2017)
- Leak, Anne E., Rothwell, Susan L., Olivera, Javier, Zwickl, **Benjamin**, Vosburg, Jarrett, and **Norris Martin, Kelly**. Examining problem solving in physics-intensive Ph.D. research. *Phys. Rev. Phys. Educ. Res.* **13**, 020101 (2017)
- Leak, Anne E, Webster, Christopher, Cammarota, Christian, **Zwickl, Benjamin**. Physics students' perceptions about seven aspects of innovation and entrepreneurship, Proceedings of the 2018 Physics Education Research Conference (under review)
- Hu, Dehui, Zwickl, **Benjamin**, Examining students' personal epistemology: the role of physics experiments and relation with theory. Proceedings of the 2017 Physics Education Research Conference. Cincinnati, OH: 2017, pp. 11-14
- Santangelo, Brianna, Young, Nicholas, Leak, Anne, **Martin, Kelly, Zwickl, Benjamin**. Integration of mathematics and communication in physics-intensive workplaces. Proceedings of the 2017 Physics Education Research Conference. Cincinnati, OH: 2017, pp. 352-355
- Young, Nicholas T, Santangelo, Brianna, **Martin, Kelly**, Leak, Anne, **Zwickl, Ben**. Models of math use in non-academic workplace settings, Proceedings of the 2017 Physics Education Research Conference. Cincinnati, OH: 2017, pp. 452-455
- Zwickl, Benjamin**, Chen, Kingston, Deslongchamps, Joshua, Leak, Anne, Characterizing analytical and computational mathematics use during PhD Research, Proceedings of the 2017 Physics Education Research Conference. Cincinnati, OH: 2017, pp. 476-479
- Leak, Anne, Cawley, Nate, Barton, Linda, Zwickl, **Benjamin**. Examining students' perceptions of innovation and entrepreneurship in physics. Proceedings of the 2017 Physics Education Research Conference. Cincinnati, OH: 2017, pp. 236-239
- Goudreau Collison, Christina**, Cody, Jeremy, Anderson, Jason, Edelbach, Brian. REActivities Organic Chemistry Lab Workbook, 1st ed.; Xanadu: Acton, MA, **2018** (ISBN: 139781506698540)
- Collison, Christina**, Cody, Jeremy, Kim, Thomas, Anderson, Jason, Edelbach, Brian, Marmor, William, Kipsang, Rodgers, Ayotte, Charlie, Saviola, Daniel, and Niziol, Justin. "Transforming the Organic Chemistry Lab Experience: Design, Implementation, and Evaluation of Reformed Experimental Activities (REActivities)" *J. Chem. Educ.* **95**, **2018** 55-61.
- Martin, K. N.**, Gaffney, A. L. H., Leak, A. E., Nelson, J., Cervantes, A. T., Gardner, K. L., Clark, B. L., **Zwickl, B. M.** (2018). Spewing Nonsense [or not]: Communication competence and socialization in optics and photonics workplaces. *Communication Education*, *67*(4), 414-437.
- Leak, A. E., Santos, Z., Reiter, E., **Martin, K. N.**, & **Zwickl, B.** (2018). Hidden factors that influence success in the optics workforce. *Physical Review Physics Education Research*, *14*.
- Leak, A. E., Rothwell, S. L., Olivera, J., **Zwickl, B.**, Vosburg, J., **Martin, K. N.** (2017). Examining problem-solving in physics-intensive PhD research. *Physical Review Physics Education Research*, *13* (2).
- Martin, K. N.** (2017). Qualitative Research Question. *International Encyclopedia of Communication Research Methods*. John Wiley & Sons Inc. <http://onlinelibrary.wiley.com/book/10.1002/9781118901731>

Martin, K. N. (2017). Artifact analysis. *International Encyclopedia of Communication Research Methods*. John Wiley & Sons Inc. <http://onlinelibrary.wiley.com/book/10.1002/9781118901731>

Santangelo, B., Young, N., Leak, A. E., **Martin, K. N.**, & **Zwickl, B.** (2017). Integration of mathematics and communication in physics intensive workplaces, *Proceedings of the 2016 Physics Education Research Conference*.

Presentations

1. Anderson J, **Newman DL**, Edelbach B, **Collison CG**, Cody J (August, 2018). Gauging the Impact of Organic Chemistry REActivities at a four-year and a two-year institution. Oral presentation at the *Biennial Conference on Chemical Education*, South Bend, IN.
2. **Newman DL** and **Wright LK** (July, 2018). How to Get More Out of Conceptual Assessments. Oral presentation at the *Society for the Advancement of Biology Education Research 8th Annual Meeting*. Minneapolis, MN.
3. **Christina G. Collison**, Jeremy Cody, Dina Newman, Matthew Jackson, Maddie Tebrugge, and Cameron Isaac “Reformed Experimental Activities (REActivities)” **2018 ACS National Meeting: (Workshop)** Biennial Conference in Chemical Education, Notre Dame, South Bend, IN United States, July 30, 2018 WMA30.
4. **Wright LK** and **Newman DL** (July, 2018). High school teacher conceptions and lessons about meiosis reveal a critical gap in the biology curriculum. Oral presentation at the *Society for the Advancement of Biology Education Research 8th Annual Meeting*. Minneapolis, MN.
5. Dy, GE, **Wright LK**, and **Newman DL** (July, 2018). Visual Representations of Meiosis in Biology Textbooks Fail to Provide Important Conceptual Information. Poster presented at the *Society for the Advancement of Biology Education Research 8th Annual Meeting*. Minneapolis, MN.
6. Magalhaes RM, **Newman DL**, Hane EN, Michel LV, Connelly J, **Franklin SV** (July, 2018). Inclusive Excellence: A Three-Pronged Approach to Increasing Diversity and Retention in Science. Poster presented at the *Society for the Advancement of Biology Education Research 8th Annual Meeting*. Minneapolis, MN.
7. Grace E. Dy., **Wright, L.K.**, and **Newman, D.L.**, (2018). Evaluating Representations of Meiosis in Textbooks Using the DNA Triangle. Poster presented at the *Society for the Advancement of Biology Education Research 8th Annual Meeting*. (Minneapolis, MN.) July 29-Aug 1.
8. **Wright, L.K.**, and **Newman, D.L.**, (2018). High school teacher conceptions and lessons about meiosis reveal a critical gap in the biology curriculum. Oral presentation at the *Society for the Advancement of Biology Education Research 8th Annual Meeting*. (Minneapolis, MN.) July 29-Aug 1.
9. **Howard J**, **Wright LK** and **Newman DL** (April, 2018). Conceptualizing Information Flow: from Concrete to Abstract. *26th Annual C-STEP Statewide Student Conference*. Bolton Landing, NY.
10. **Franklin, Scott V.**, Embedding physics concepts in mathematical formalism, Texas A&M University – Commerce (February 15, 2018)
11. **Franklin, Scott**, Emergent methods of science education research: quantitative and qualitative studies, University of Rwanda, Rukara, Rwanda (January 22, 2018)

12. **Martin, K.** (2017, November). Activating visual communication theory and analysis in the classroom. National Communication Association, Dallas, TX.
13. **Martin, K.**, Worrell, T. (2017, November). New Evidence for the Importance of Design Instruction and the Development of Design Scales. National Communication Association, Dallas, TX.
14. **Wright, L. Kate.** (2017). Interactive Video Vignettes: Out-of class Priming Tools to Improve Student Learning of Biology Core Concepts. Oral presentation given at at the *American Society for Microbiology Conference for Undergraduate Educators (ASMCUE) 24th Annual Meeting.* (Denver, CO). July 27-30.
15. **Wright, L. Kate and Newman, Dina L.** (2017). Exploration of the DNA Triangle and its Application to Learning Molecular Biology. Poster presented at the *Society for the Advancement of Biology Education Research 7th Annual Meeting.* (Minneapolis, MN.) July 21-23.
16. Stefkovich, M., **Newman, D.L.**, and **Wright, L.K.** (2017). 3-D Physical Model-based Activities Benefit Student Learning in Multiple Ways. Poster presented at *the Society for the Advancement of Biology Education Research 7th Annual Meeting.* (Minneapolis, MN.) July 21-23
17. Leak, A. E., Santos, Z., Reiter, E., **Martin, K. N.**, & **Zwickl, B.** (2017). Blackbox Science: Hidden Science Practices used in the Optics Workplace. American Association of Physics Teachers (AAPT) Summer Meeting. July 22-26, 2017. Cincinnati, OH.
18. Santangelo, B., Young, N., Leak, A. E., **Martin, K. N.**, & **Zwickl, B.** (2017). Communicating and Using Math in the Optics and Photonics Workforce. American Association of Physics Teachers (AAPT) Summer Meeting. July 22-26, 2017. Cincinnati, OH.

Students Mentored

The SMERC group plays a large role in mentoring Rochester Institute of Technology undergraduate students, as well as undergraduate students from other universities, to support experiential learning. SMERC members' consistent involvement with student-centered research aligns with RIT's strategic plan of becoming a student-centered research university.

Scott Franklin

- Emily Watson (graduate student, Astrophysical Sciences and Technology Program)

Christina Goudreau Collison

- Kaitlyn Houghtling: BS in Chemistry RIT '18
- Tyler Zimmerman: BS in Chemistry RIT '18
- Matthew Jackson
- Maddie Tebrugge
- Cameron Isaac:
- Micaela Nelson
- Darren Chee
- Asma Sheikh
- Zexuan Jia
- Diksha Biswa

- Wasim Zatar
- Kaitlyn Clark
- Laura Anne Hirschler

Ben Zwickl

- Vina Macias
- Jacob Mekker
- Chris Webster
- Jacob Poirier
- Kingston Chen (Capstone)
- Jessica Hathaway (Elizabeth City State University)
- Myers Weidner

Dina Newman and Kate Wright (co-mentored)

RIT students AY 2017-2018:

- Ashley Adair, B.S. in Biotechnology and Molecular Biosciences RIT '18; now at Yale University
- Jordan Cardenas, B.S. in Biotechnology and Molecular Biosciences RIT '18; now at Colorado State University
- Regina Chartier
- Callie Donahue, B.S. in Biotechnology and Molecular Biosciences RIT '18; now at Boston University
- Jesse Howard
- Yara Rose
- Patrick Rynkiewicz

From REU summer 2017:

- Fidel Amecuza (Dina Newman only), Chicago State University
- Grace Elizabeth Dy (also summer 2018), University of Washington
- Kaitlyn Elliott, University of Colorado at Denver
- Muhammad Jan, University of Alabama at Birmingham
- Daniel Mendoza, University of Alabama at Birmingham

Kelly Norris Martin

- Jes Nelson, RIT School of Communication
- Alexandria Cervantes, University of California Monterey Bay
- Katherine Gardner

Other Notable Achievements

Scott Franklin

2018 Outstanding Referee of the Physical Review Journals

Dr. Scott Franklin, Associate Professor in the School of Physics and Astronomy is one of 147 Outstanding Referees of the Physical Review Journals, as chosen by the journal editors for 2018.

Dina Newman

2018 College of Science Faculty Leadership Development Program

Chosen as faculty representative for Inclusive Excellence

2018 Nominated for RIT Eisenhart Award for Outstanding Teaching

Ben Zwickl

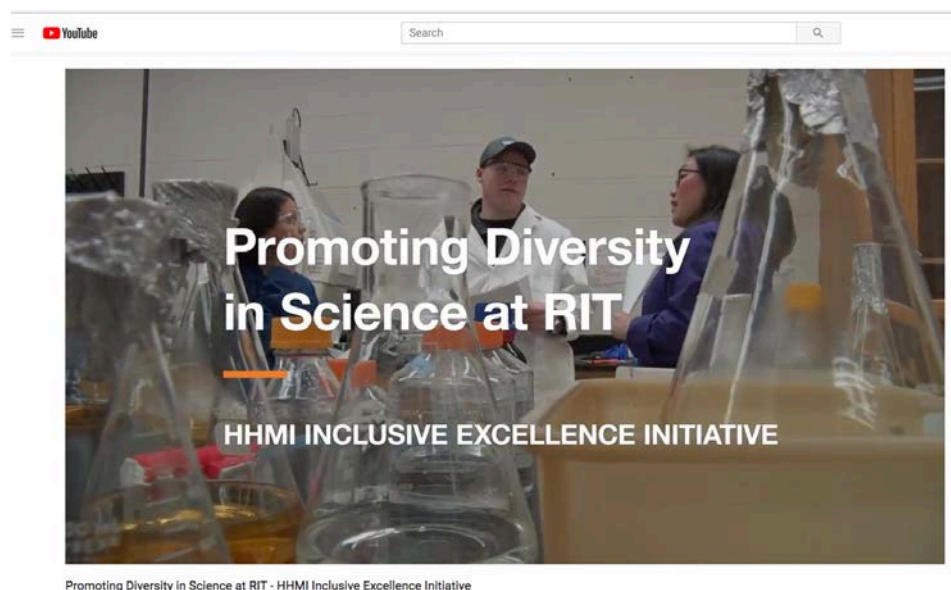
Class of PI Millionaires

Dr. Zwickl was one of 10 researchers inducted into the next class of PI Millionaires, a designation given to RIT researchers who have achieved funding of \$1 million or more since 2000.

Web, Social Media, and In The News Presence

The CASTLE site is located at rit.edu/castle. It serves as a home-base for all CASTLE-affiliated programs, research and initiatives. Having completed year 1 of the 5-year Inclusive Excellence initiative, a video was created explaining the program and added to the CASTLE site.

<https://www.youtube.com/watch?v=WyF9WD2CtEA>.



Promoting Diversity in Science at RIT - HHMI Inclusive Excellence Initiative

CASTLE Center for Advancing STEM Teaching, Learning & Evaluation

News Spotlight Support Us
About Research Programs People

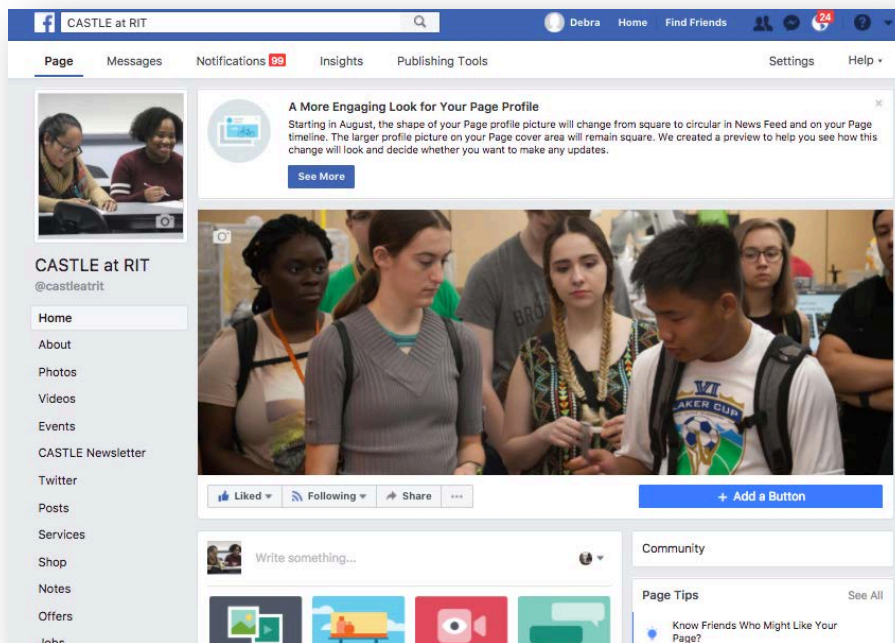
The CASTLE Center for Advancing STEM Teaching, Learning & Evaluation is a network of faculty, projects and programs engaged in scholarship surrounding STEM education.
Read More >

Events

SEP 18	SMERC-in-Progress Meeting Sep 18 2:30 pm to 3:30 pm	Sep 18
SEP 19	SMERC Journal Club Sep 19 3:00 pm to 4:00 pm	Sep 19
SEP 20	CASTLE / SMERC Seminar: Kimberly Tanner Sep 20 1:25 pm to 2:20 pm	Sep 20

RIT HHMI Inclusive Excellence Initiative

Social media direct links to Facebook and Twitter pages for CASTLE, IMPRESS and DBER all reside on the CASTLE website.



In The News



Building a Strong, Inclusive Community

By: Debra A. Jacobson

Being a participant in RIT's Diversity Theatre workshops can be a growth experience for many—it certainly was for me. Sharing personal stories tends to broaden the awareness of one's own mindsets and actions, as well as sets the stage to discover how best to understand and respond to others. This growth assists in promoting social change at the larger level. Watching personal stories played back in an improvisational theater setting with skilled actors definitely heightens the experience. What a creative and wonderful way to look at topics that are typically difficult to address and discuss!

"It's a very unique opportunity to raise awareness, and also redirect the ways the participants act and react within their community, says Dr. Connelly. "They are given the chance to share their own stories as well as experience the stories of others. It's not just a passive process, but involves them directly in the lives of others in their scientific field, giving them insights and new ways to think more inclusively."

The RIT HHMI Inclusive Excellence 5-year initiative is widening the reach of participating individuals in an effort to build awareness, skills, and communication tactics toward a more inclusive environment. Community Strand Leader, Dr. Jennifer Connelly, and Director of Diversity Theater, Tina Chapman DaCosta, are soon to have completed the first series of Playback Theatre workshops of this 5-year program.

As a participant, I am extremely grateful for having had this opportunity. As a staff member, it was especially meaningful being a part of this journey alongside faculty and students—seeing us all as equals in this shared experience—excluding no one, and valuing what each had to share and offer. I for one, learned ways to spot check my own thoughts for unconscious biases or reactions, which in turn would help me re-direct them to a better place of understanding and openness to others.

Faculty, staff and students from the School of Physics and Astronomy will have taken part in four workshops on topics pertaining to inclusion, unconscious bias, bystander awareness, and concluding with a transformative experiences session. The work will continue, with facilitators inviting new participants from the College of Science. The work of this grant starts with deepening inclusivity of individuals from excluded identity groups in the STEM natural sciences, with the hope that this will eventually spread campus-wide.

Those taking part in the improvisational Playback Theatre workshops anticipated the actions that followed Director Chapman DaCosta's "Let's Watch" prompt to the actors.

"In some cases, there are sides to the story that we haven't thought about before that the Playback Theatre allows us to see from a third person's perspective," comments graduate student participant, Yashashree Jadhav. "It lets us reflect on the incident, and even perhaps our actions, and see how we can make a change in the future."



As the workshops progressed with the same participating cohort, the comfort levels and trust built. After discussing strategies of being an active bystander, Chapman DaCosta offered participants the chance to replay their role, changing their approach after seeing the actors playback of their story. It brought the Teller, as they are called, in closer to the enactment of his/her shared occurrence, and allowed those watching to see that transpire.

Community efforts of the project continue to broaden outside of these theater workshops, where events, discussions, coffee chats, seminar speakers and gatherings are open to all on campus.

One of the highlights this semester was the opportunity to extend an invitation campus-wide to watch the 2018 Academy Award-winning Live Action Short Film, *The Silent Child*, organized by Inclusive Excellence Research Strand Leader, Lea Michel. The film starred a 4-year old deaf girl who lived in a silent world until a compassionate social worker teaches her sign language. A post viewing discussion with a carefully selected panel opened up conversation about this controversial community and school responsibility. The panel consisted of the following individuals: Deirdre "DD" Schlehofer, Associate Professor in the Department of Cultural & Creative Studies at RIT/NTID; Kaitlin Stack Whitney, RIT Visiting Assistant Professor in College of Science and a hearing parent of two ASL-using deaf children; and Stephanie Smith Albert, Director of NTID Diversity and Inclusion. The panel moderator was Tina Chapman DaCosta, Director of RIT Diversity Theater in the Office for Diversity & Inclusion, a senior lecturer in the College of Liberal Arts, and a filmmaker.

Inclusive Excellence work is being done in the Research and Classroom Practice strands as well. Beth VanWinkle, a faculty participant in the Classroom Practice Strand is holding Maker Fridays. During these sessions students journal in the form of poetry, paintings, drawings, writings, games they have designed, craft projects, videos, songs and more. These efforts include novel ways of thinking about a topic and encourage reflection and sharing. This spring, seven freshman and transfer students were matched with faculty members from the first Faculty Research Mentor cohort. These students will receive stipends to work with their mentors on research projects full-time over the summer.

For more information on Inclusive Excellence visit InclusiveExcellence@rit.edu.



Campus Spotlight



March 8, 2018

Photo by Elizabeth Lamark



RIT held a special showing March 8 of *The Silent Child*, this year's Academy Award winning Best Live Action Short Film directed by directed by Chris Overton and written by and starring Rachel Shenton. The 20-minute movie depicts a 4-year-old deaf child whose life transforms when a social worker teaches her sign language. A panel of RIT and NTID faculty members discussed the film's social ramifications. Here, Kaitlin Stack Whitney, visiting assistant professor in RIT's environmental sciences program, shares her insights with the audience. The private showing of *The Silent Child*, was arranged by Lea Vacca Michel, assistant professor in RIT's School of Chemistry and Materials Science, and hosted by RIT's Howard Hughes Medical Institute's Inclusive Excellence program. Work has started on a full-length sequel to *The Silent Child*.

Inclusive Excellence cultivates diversity in research and mentoring Program focuses on biology, chemistry and physics

Aug. 27, 2018

by [Susan Gawlowicz](#)

[Follow Susan Gawlowicz on Twitter](#)

[Follow RITNEWS on Twitter](#)



FACEBOOK



TWITTER



LINKEDIN



REDDIT



RIT's [Inclusive Excellence](#) initiative is working to create a deeper understanding of diversity in the College of Science and on the RIT campus. Awareness training and compassionate communication underlie the program's three practice areas—research/mentoring, classroom practice/teaching and informal community.

The first [Inclusive Excellence](#) research fellowship was held this summer and paired seven undergraduate students in the College of Science with research mentors.

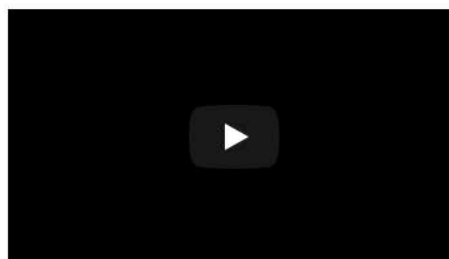
The 10-week program was supported in part from a grant awarded to RIT in 2017 from the [Howard Hughes Medical Institute](#) through the [Science Education Program](#). The Inclusive Excellence initiative is housed within [CASTLE](#) (Center for Advancing STEM Teaching, Learning & Evaluation) in RIT's College of Science.

Laurel Hunter, a third-year physics major from Hampton, Va., was in the initial cohort of research fellows. Her interest in biophysics made her a good match with George Thurston, professor of physics, who studies the molecular origins of disease. As part of Thurston's research group, Hunter learned to replicate eye-lens proteins that condense to form cataracts, the leading cause of blindness.

"It's been a good chance to get involved in my field doing research that I otherwise wouldn't have had a chance to do or even know about," Hunter said. "And it turns out I really like doing it, and I want to keep doing it. So it's been a great introduction to something that is important to me now."

The interdisciplinary nature of this project led Hunter to collaborate with Aaron Fadden, a graduate student in chemistry. Interacting with upper-level students is another layer of mentoring embedded within the Inclusive Excellence summer research program.

Hunter and Fadden successfully isolated a gamma crystallin protein found in the lens in a form suitable for study, using nuclear magnetic resonance and light scattering, Thurston said. Hunter will join his research group in the fall and hopes to continue making progress on eye-lens proteins.



Elizabeth Lamark

The first cohort of Inclusive Excellence research fellows are Nasreen Jaff, Sofie Margaret Christie, Laurel Hunter, My'Neaysia King, Rebecca (Ruby) Zathang (in back), Jennifer Pfaff and Ricardo Carrion. The College of Science students presented their research at the RIT Undergraduate Research Symposium in August.

Laurel Hunter spells her last name, "H-U-N-T-E-the sound a pirate makes."

She has a lisp and is the daughter of a deaf adult.

"I can't always hear the difference between certain sounds," she says. "That means partly that I can't hear accents and partly that I can't say my own name!"

Hunter identifies as diverse in a few other ways besides just the way she speaks. And ordinarily, that might deter her from studying the sciences. But, she came from a long line of science and math professionals, so she decided to major in physics at RIT -- even though she's in the minority.

"Going into the next semester there are going to be maybe two girls total in the room

with me and that can be a little bit daunting. A question you're not just asking for yourself, but for others to think, 'Oh, girls just don't understand

This summer, Hunter says she didn't forget the Inclusive Excellence summer program, which is designed to bring diverse backgrounds to mentors and

The program was started to foster a more inclusive environment

Assistant Professor Kaitlin Stack White says she can identify with the experience

"My background is in entomology, I still feel like I'm part of an underrepresented community in student

The inclusivity program doesn't just affect students

"It's really important to think about, and work on, diversifying, how we support everyone

The Inclusive Excellence initiative is a continuous effort.

The screenshot shows a news article from WXXI News. At the top, there is a navigation bar with the WXXI NEWS logo and a 'Go P' button. Below the navigation bar is a video player for 'WXXI AM News Here and Now'. The main content area features the article title 'RIT working to foster inclusion in the sciences' by Veronica Volk, dated August 3, 2018. There are social media sharing options for Twitter, Facebook, Google+, and Email. A 'Listen' button with a play icon and a 1:32 duration is also present. Below the text, there is a photo of a young woman with glasses, wearing a patterned lab coat and blue gloves, working with scientific equipment in a laboratory setting. A caption below the photo reads: 'A program at RIT aims to increase inclusion in the sciences. WXXI's Veronica Volk has this story.'

NEWSLETTER FEBRUARY 2018 /

Diversity Theater Plays Key Role in RIT HHMI Inclusive Excellence Grant Initiative



Diversity Theater Plays Key Role in RIT HHMI Inclusive Excellence Grant Initiative

By Debra A. Jacobson, Marketing Specialist | Center for Advancing STEM Teaching, Learning & Evaluation (CASTLE)/Inclusive Excellence

The arts are a unique and engaging way of communicating stories and key messages. Music, theater, and the visual arts can hone in on emotions—revealing aspects of life that resonate with or enlighten the viewer or listener.

Playback Theatre is an artistic form that is especially effective at guiding the audience to see other points of view and helps enable difficult conversations. The improvisational theatrical form forwards the right for any and all voices to be heard—ultimately stimulating dialogue— and is now performed world-wide, being used in schools, prisons, private sector organizations, hospice centers, disaster recovery, birthday parties, weddings and more.

Within the Division of Diversity and Inclusion at RIT, Tina Chapman DaCosta, Director of Diversity Theater, is using Playback Theatre methods to connect people through the arts. Her work includes the Inclusive Excellence (IE) Initiative in the College of Science. The program, funded by a grant from the Howard Hughes Medical Institute, focuses on three areas or strands: Research Mentoring, Classroom Practice, and Community. DaCosta is working with community strand leader Dr. Jennifer Connelly of the School of Physics and Astronomy, to foster community, emphasizing experiences and understanding of inclusion.

Playback Theatre has already been incorporated into workshops for community liaisons and a Diversity Theater session with faculty, staff and students from the School of Physics and Astronomy (SoPA). Audience member stories were enacted on the spot by Diversity Theater actors, allowing personal struggles or successes surrounding biases and inclusion to be shared.

“When Jen asked me to provide a Playback Theatre (PBT) community building aspect for the HHMI proposal, I was pleased to have the opportunity to engage the College of Science in the PBT experience,” comments Chapman DaCosta. “The four PBT workshops are designed in a phased-approach for a cohort of 24 students, faculty and staff to experience a common Diversity & Inclusion theme together. The first workshop, *Inclusion Starts with I*, allowed participants to share personal stories about when they felt included which led to sharing exclusion stories as well. This enabled the participants to know each other better, thus completing the first phase of community building.”



Three more Diversity Theater sessions with this year’s SoPA participants will take place during the spring semester. The remaining PBT workshop themes are: *Unconscious Bias & Diversity Awareness*, *Active Bystander Awareness* and *Transformative Experiences*. The series will then be repeated with a new group from Physics and adding groups from Biology and Chemistry, extending the community building work and awareness around inclusion in STEM education at RIT each year.

More about Inclusive Excellence

Six months into the five-year grant project, the Inclusive Excellence (IE) team has organized and held more than 30 grant-related events. Forty-one faculty from the Schools of Physics & Astronomy, Biology, and Chemistry & Materials Science participated in at least one program activity.

What does it take to make an institution more diverse?

Six researchers share their ideas for improving representation.

LEA MICHEL: Take action Biochemist at Rochester Institute of Technology (RIT), New York; **director of research for RIT's Inclusive Excellence programme.**



Lea Michel leads a diverse lab group in biochemistry research. Credit: Lea Michel

I've learnt that the more diverse the lab, the better — but it is also important that a recruit from a minority group does not feel isolated. We have a National Technical School for the Deaf on campus. When I hired my first deaf student, I didn't realize that the student was terrified of me as we struggled to learn how to communicate clearly with each other. Now, I have a student in a wheelchair and five deaf students. There is power and comfort in numbers.

My 20 lab members are Asian, African American, Hispanic and Caucasian. One-third are first-generation students. My lab group has never been so productive and engaged. Is there a correlation? I think so. I chose them not because they were different, but to recognize their individual strengths.

Diversity has become increasingly important at my institution, a technical school whose population consists of 65–70% male students and faculty members. In 2008, among RIT's total student population, 10.8% identified as African American or black, Latin or Native American. In 2017, that number was 15.2%.

In 2012, we won a US National Science Foundation ADVANCE grant, which supports women in science, that triggered a huge transformation — an effort to focus on diversity issues. We have a long way to go, but in the past five years, we have streamlined the process for students and postdocs to take advantage of programmes such as parental leave and stopping the tenure clock.

In 2017, we also received a US\$1-million Howard Hughes Medical Institute Inclusive Excellence Initiative grant to attract underrepresented minorities across considerations of ethnicity, sexual orientation, socio-economic background and physical disability. We are working to change how faculty members think about mentoring students. Students from under-represented groups aren't going to come to me if they don't think they belong, or if they believe they must already know how to do research to be considered. As mentors, we need to reach out to undergraduates in their first year and welcome them into our labs. Admission to our summer research programmes requires only a short essay. We want students to identify characteristics in themselves that will make them good researchers, and for faculty members to recognize those as useful for their team.

UNIVERSITY NEWS

Nov. 1, 2018



NEWS STORIES

MORE NEWS

RESOURCES

MULTIMEDIA

CONTACT

Campus Spotlight



Sept. 21, 2018

Photo by Elizabeth Lamark

FACEBOOK	TWITTER	LINKEDIN	REDDIT	EMAIL
----------	---------	----------	--------	-------

The Inclusive Excellence program uses Playback Theatre Community Building Workshops to create stronger bonds between faculty and students. The program is part of RIT's CASTLE.

[previous](#)

[Photo archive](#)

[next](#)