Yeshiva University
STERN COLLEGE FOR WOMEN

Volume XVI

WOMEN IN SCIENCE

2021-2022

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Acknowledgments

Many were involved in creating volume 16 of *Women in Science* and appreciation is expressed to:

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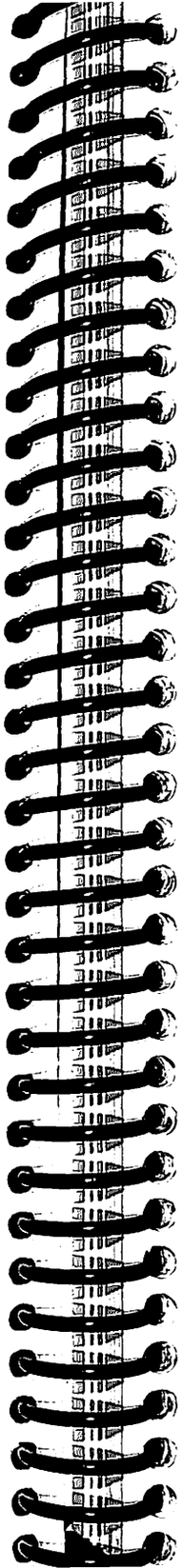
Ilana Aidman for the cover design and layout of this publication.



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Student Co-Editors

Sarah Berman

Shani Adest

Cover Design, Layout Editor

Ilana Aidman

Introductory Remarks

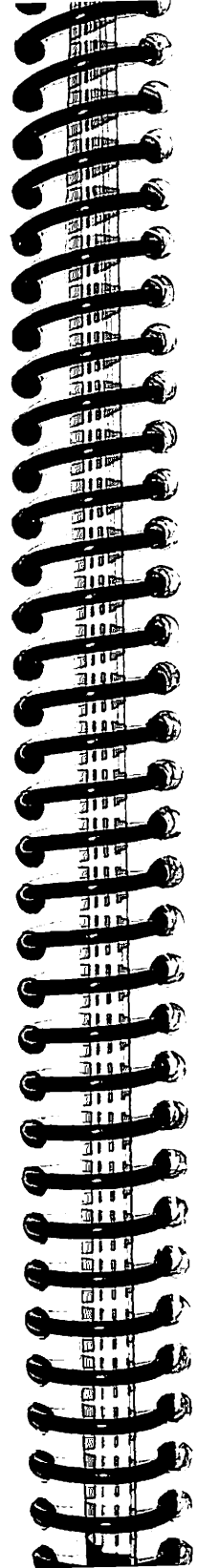
The COVID-19 pandemic of 2020-2021 not only illustrated how vital scientific progress is to humanity, but also how vital humanity is to scientific progress. While the past eighteen months forced people apart and showed declined productivity worldwide, the students and faculty at Stern College for Women (SCW) came together to ensure that that a top-notch STEM education was delivered, even if the delivery method was novel. SCW students, faculty and staff came together in person or on zoom to learn, to educate, to experiment and to grow, ensuring that the worldwide setback could still provide learning and growth opportunities for our students. Students benefitted from a faculty that quickly pivoted to zoom in March, 2020 and pivoted again in August, 2020 to provide hybrid lectures, as well as at-home and in-person labs. Our students participated in virtual and in-person internships, worked as EMTs, volunteered at local hospitals, at the university testing facility and at city-run vaccine clinics. Our students, faculty and staff continued to demonstrate a high level of commitment to academic rigor, combined with sensitivity and understanding to ensure that we progressed as best as possible through these trying times. As the rates of vaccination increase, and the world continues to benefit from scientific progress, we stand ready again to take what we've learned these past eighteen months and apply it to the new future, where a solid STEM education combined with a high level emotional intelligence is ever more important.

A STEM education at SCW prepares our students for the varied careers in the biomedical, health, natural sciences, physical sciences, and behavioral sciences. The Departments of Biology, Chemistry/Biochemistry, Computer Science, Mathematical Sciences, Physics, Psychology and Speech Pathology/Audiology, each unique in its specific discipline, share a proactive approach in promoting the academic and social/emotional success of students at SCW and in helping them achieve their career goals. Our students leave SCW prepared for their graduate programs in medicine, dentistry, osteopathy, optometry, veterinary science, psychology, physical therapy, occupational therapy, physician assistant, nursing, genetic counseling, pharmacy, nutrition, speech pathology/audiology, education, social work, and law; masters programs in biotechnology, bioethics, public health, engineering, architecture, and bioinformatics; and doctoral programs in the biomedi cal sciences, computational biology, chemistry, physics, neuropsychology,

clinical psychology, and school psychology. A science education at SCW is a stepping-stone to any career and a cornerstone of our students' success.

The above-noted direct students to stretch beyond the classroom experience by involvement in scientific research. Both in the academic year and in the summer, students may work one-on-one with on-campus faculty. Beginning in the Summer, 2011, a collaborative interaction between Bar Ilan University and Yeshiva University enabled SCW and Yeshiva College (YC) undergraduates to intern in research laboratories in Bar Ilan University and, thereby, to spend a summer in Israel. In the summer 2021, 10 SCW undergraduates participated in this summer laboratory experience, now termed the YU/Bar Ilan Summer Research Program. The science faculties actively encourage the science majors to apply for competitive undergraduate research internships, locally, nationally, and internationally. Although the COVID-19 pandemic limited undergraduate summer research opportunities, many students overcame this obstacle. In the summer of 2021, an additional 20 SCW students were involved in research in a variety of laboratory facilities, including on-campus at SCW and Yeshiva College, and at Albert Einstein College of Medicine (AECOM), The Rockefeller University, Ferkauf Graduate School of Psychology, and the Health Careers Opportunity Program at the Rusk Institute for Rehabilitative Medicine, NYU. Undergraduates majoring in computer science received summer internships at Amazon Web Services. The pandemic put a damper on summer research internships, as SCW usually averages between 60-70 students accepted into summer undergraduate research internships.

The Jewish Foundation for Education of Women (JFEW) Fellowship Program now marks its thirteenth year, with over 120 graduates of the program. The JFEW Program was inaugurated in the 2009-2010 academic year, with a select group of ten participating students with interests in the sciences. Each subsequent year, an additional cohort of students joined the program. The 2017-18 academic year marked the first in which the JFEW Program was expanded to support both science- and liberal arts-focused students. Highlights of the JFEW Fellowship Program include a partial scholarship, a stipend for a summer research internship, a stipend to support professional conference attendance, one-on-one mentoring by a faculty member, and an enrichment program that provides workshops on academic and professional development. Since its inception, JFEW Fellows



have obtained internships in a variety of fields of including psychology, cancer cell biology, veterinary medicine, neurobiology, healthcare, molecular biology, computer science, biochemistry, and sociology. The Fellows have interned in prestigious institutions, including the University of Chicago, Emory University, AECOM, The Rockefeller University, Johns Hopkins University, Harvard Medical School, Rutgers University, New York University, Yale University, Barrow Neurological Institute, Hadassah Hospital, Bar Ilan University, Weizmann Institute, Tel Aviv University, and in industry, Citromax. Several of the JFEW students have taken leadership roles in forming and/or leading the Neurobiology Club, the Genetics Club, the Optometry Club, and the Medical Ethics Society. Graduates of the program are currently pursuing careers in various science and health-related fields: medicine, dentistry, physical therapy, occupational therapy, nursing, public health, biomedical engineering, math education, food science, psychology, and veterinary medicine. The JFEW Program provides participants with, in addition to the above, a built-in network and support system of like-minded peers, graduates, and faculty.

The Jewish Foundation for Education of Women (JFEW) Fellowship Program now marks its tenth year, with over 70 graduates of the program. The JFEW Program was inaugurated in the 2009-2010 academic year, with a select group of ten participating students with interests in the sciences. Each subsequent year, an additional cohort of students joined the program. The 2017-18 academic year marked the first in which the JFEW Program was expanded to support both science- and liberal arts-focused students. Highlights of the JFEW Fellowship Program include a partial scholarship, a stipend for a summer research internship, a stipend to support professional conference attendance, one-on-one mentoring by a faculty member, and an enrichment program that provides workshops on academic and professional development. Since its inception, JFEW Fellows have obtained internships in a variety of fields of including psychology, cancer cell biology, veterinary medicine, neurobiology, healthcare, molecular biology, computer science, biochemistry, and sociology. The Fellows have interned in prestigious institutions, including the University of Chicago, Emory University, AECOM, The Rockefeller University, Johns Hopkins University, Harvard Medical School, Rutgers University, New York University, Yale University, Barrow Neurological Institute, Hadassah Hospital, Bar Ilan University, Tel Aviv University, and in industry, Citromax. Several of the JFEW students

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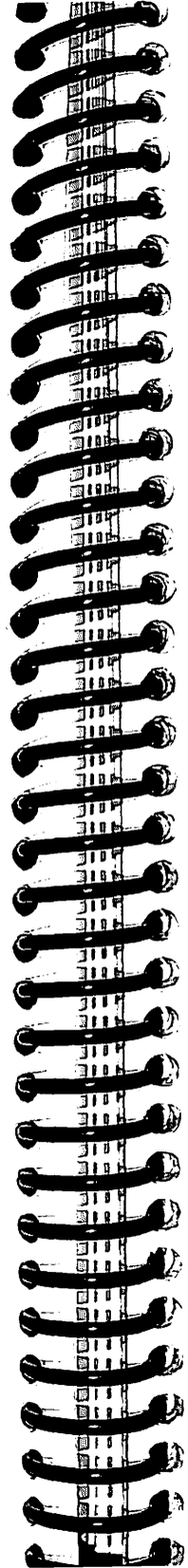
The Department of Mathematical Sciences and the Department of Physics owe to the illustrious tradition in mathematics and physics at Yeshiva University, whose notable alumni and former faculty include Paul Dirac, Roger Penrose, Freeman Dyson, and Hillel Furstenberg. Today's B.A. program, M.A. program, and Ph.D. program, continue offering a high-class education, providing preparation for careers in technology, finance, economics, business, or academia. A personalized curriculum, integrated research and training, and one-on-one mentoring are keys for our students' success. We also offer a variety of enrichment activities at SCW, including the math club, "No Limits", city wide seminars in Dynamical Systems and/or Mathematical Physics, and the Physics Colloquium. Graduates of our programs have been employed by Google, Goldman Sachs, Citigroup, Merrill Lynch, and Bank America, or pursued advanced degrees in physics, mathematics, engineering, computer science, and even law at Harvard, Yale, MIT, Princeton, Columbia, and New York University.

The mission of the Department of Computer Science is to prepare students for employment in various fields of computer science and/or to pursue advanced studies in computer science. In addition to covering fundamentals of Computer Science theory and practice, department courses help students maximize their portfolios of significant coding projects. The courses are structured to expose students to a variety of programming languages in a broad range ofapplication areas. Students who complete this program should be well versed in the disciplines of object-oriented design and development, the architectures of software and hardware systems, the theory and practice of programming language technology, the construction and use of data structures and algorithms for the solution of large-scale computing problems, and the theory and application of database systems. There is a strong emphasis in the Department on preparation for challenging jobs



in industry - our faculty and adjuncts come from positions of intensive industrial experience and leadership. Students in the department are involved in Computer Science outside the classroom - through an active ACM-W chapter, by participating in regional and national hackathons, and by working in internships at well-known firms, such as Google, Facebook, Microsoft, Palantir, Goldman Sachs, and many others. Honors students in our program work with faculty on computational research projects, preparing them for graduate level work, and/or prime industrial positions.

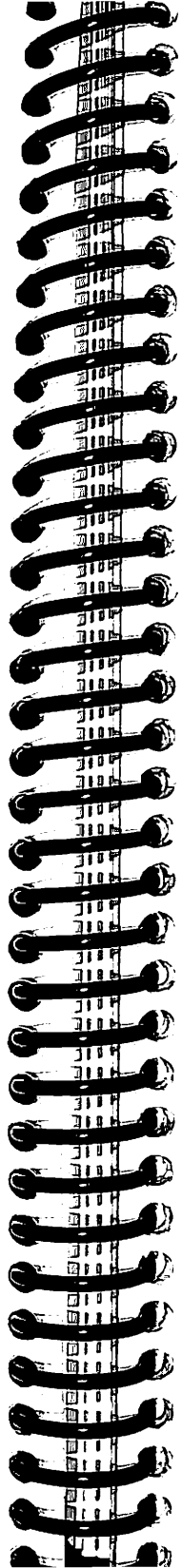
The Department of Psychology offers an Honor's Research Seminar for upper-level psychology majors. As part of this seminar, students are involved in ongoing research projects, either at SCW or at off-campus sites, such as the Ferkauf Graduate School, NYU Medical Center and Mt. Sinai School of Medicine, among others, and are supervised by an on-site investigator for 6 hours/week for 12 weeks. The primary requirement for the course is a comprehensive literature review and/or scientific report of the students' research projects, as well as a class presentation. The combination of internship and seminar allows the students to gain practical experience in literature review, data collection and management, and scientific writing and oral presentations. Students attending graduate programs in Clinical Psychology have identified the research seminar as being particularly helpful in preparing them for graduate school.

To meet growing student interest in the neurosciences, programs in neurobiology were instituted by a collaborative interaction between the Department of Psychology and the Department of Biology. In these programs, students complete a prescribed combination of courses in biology and in psychology (with each Department emphasizing its own requirements) and upon successful completion of the program, the designation "concentration in the neurosciences" is included on the college transcript.

The Speech Pathology/Audiology Department provides the academic and pre-clinical experiences to begin graduate studies, either for an M.S. in speech pathology or a Ph.D. in audiology. As part of the "extra-curricular" activities of the Department, students edit, manage and publish a journal, reflecting either a unique research project or a literature review. The topics include speech language pathology, audiology, or speech and hearing science. Some students participated in a research

project involving dysphagia and dysphonia associated with anterior cervical spine surgery. These students were part of a project conducted at the North Shore Hospital, reviewing patient data and research materials. The Speech Pathology/Audiology Club hosted renowned professionals to address clinical experiences, research projects, and career issues.

A specific objective of the science departments at SCW, in addition to nurturing the highest level of academic achievement, is to provide students with opportunities for leadership roles. Upper-level students may be appointed to positions as Teaching Assistants (TAs) for laboratory sections and as Recitation Instructors to review materials for the lecture sections of the science courses. Student-led clubs, such as the Biology Club, the Chemistry Club, the Physics Club, the Physical Therapy Club, the Psychology Club, the PreMed Club, the PreDent Club, the Occupational Therapy Club, the Pharmacology Club, the Nutrition Club, the Global Health Club, the Pre-Engineering Club, the Nutrition Club, the Bikur Cholim Club, *etc.*, provide opportunities for students to gain skills in organizing events and in coordinating social functions. The 2010-2011 academic year saw the birth of four new clubs, the Nursing Club, the Genetics Club, the Optometry Club, and the Neuroscience Club. The Public Health Club was launched during the 2011-2012 academic year; beginning in the fall semester 2016, the college instituted a minor of public health. The Physician Assistant Club was started in the 2012-2013 academic year to spur interest in an increasingly popular field. These Clubs often invite outside speakers to lecture and to conduct question-and-answer sessions on a variety of interesting topics. Due to the pandemic, in-person events were shelved after March, 2020, but the Clubs rose to the occasion by organizing informative Zoom events and webinars. The Nursing Club has in the past held a number of particularly well-attended events, including an information session with admissions officers from the nursing programs at Columbia University, Fairleigh Dickinson University, NYU and Pace University. It later organized a guided tour of the NYU College of Nursing. The Nursing Club also held a joint information session with the Physician Assistant Club in December 2018. The Occupational and Physical Therapy Clubs likewise joined forces during the fall 2018 semester to run a career panel of Stern alumni in their respective fields. In February 2019, the OT Club invited Nicolaas van den Heever, the founding director of the new Yeshiva University Occupational Therapy Doctorate (OTD) program, to speak about this



exciting new program at the Katz School of Science and Health. In May 2021, the Physician Assistant Club organized a well-attended webinar with Sharon Verity, the director of the new PA program at the YU Katz School. These student-run clubs provide students with the opportunity to develop the social and professional skills needed to succeed in their future careers and provide networking opportunities with Stern College alumni already in the field. The YU Career Center plays a vital role in carrying out this goal and organized a well-attended Allied Health Fair in April 2019, at which Stern alumni from the aforementioned professions provided guidance and counsel to current students interested in these fields. In April 2021, the Career Center conducted a virtual career panel with Stern alumni from the fields of nursing, occupational and physical therapy and physician assistant.

SURGE, the Student Undergraduate Research Group Exchange, is a faculty-sponsored, student-led club that gives students the forum to present their research as a seminar before their peers and the science faculty. The goals of this faculty-initiated club are to encourage and foster research and the exchange of research information. Meetings are held once a month, usually with two or three students presenting PowerPoint professional seminars. Faculty members also use these meetings to inform students of upcoming internships and fellowship opportunities. Because of the COVID-19 pandemic, SURGE meetings were suspended in the 2020-2021 academic year.

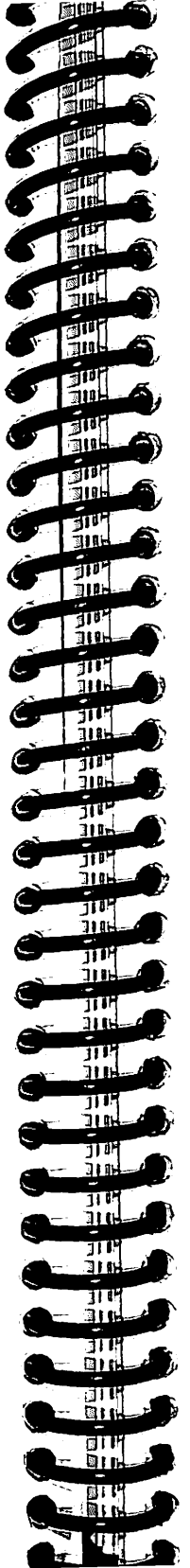
Each Fall semester, the science departments jointly sponsor a research poster competition in which students present their work. The posters, and more importantly the student's understanding of her project and the extent of her hands-on participation, are evaluated by the science faculty and winners are selected to present at a national meeting of the American Chemical Society. The costs of attending the meeting, including transportation and hotel, are underwritten by the Dean's Office, SCW, and by faculty research grants. This poster competition, canceled in the Fall, 2020, is scheduled to resume this Fall semester, 2021.

The SCW Chemistry Club, a student affiliate chapter of the American Chemical Society (ACS), was awarded a Community Interaction Grant from the ACS for the 2018-2019 academic year. The funded proposal described a continuation of educational outreach activities at an elementary NYC public school on the Lower East Side. In the Fall se-

mester, 2020, the ACS awarded the SCW Chemistry Club the Honorable Mention Chapter Award for its activities. Participation in the SCW Chemistry Club, and affiliation with the undergraduate programs office at the ACS, provides our students with invaluable experience in grant proposal writing, budget allocation, and grant reporting activities.

SCW graduates attending AECOM for their medical education are eligible to apply for Anne Scheiber Fellowships. This unique award provides up to full tuition scholarships based on need for four years of medical training (see "Anne Scheiber Fellowship"). This award has been granted to over 150 graduates of SCW.

Students considering careers in the various allied health fields (for example, occupational and physical therapy) or in engineering may wish to consider one of our several combined degree programs with other universities. In the spring term of 2009, Yeshiva University entered into a cooperative agreement with the NYU Steinhardt School of Culture, Education, and Human Development, designed to expand opportunities for students to prepare for a career in teaching math and science at the elementary and high school levels. During the fall of 2010, Stern College signed an articulation agreement to implement a combined program with the NYU College of Nursing. Students interested in this program pursue a shaped major that leads to the completion of the necessary prerequisites within five semesters for those who study for a year abroad in Israel (or seven semesters for those who come directly to Stern College after high school). If they are accepted to the program, they receive a B.A. from Stern College upon completion of their first semester at the NYU College of Nursing. Once they have successfully completed the 15-month accelerated program at NYU, they are awarded a BSN from their nursing school. This excellent new program has already admitted ten classes of SCW students and has been the basis of a productive and long-term partnership between Stern College and the NYU College of Nursing" (see "Combined Programs"). The most recent class of 12 admitted students, entered NYU via the joint program in January, 2021. For students interested in nutrition, a shaped major option exists. Students in their senior year may take up to 12 credits in approved nutrition courses at NYU towards their shaped major. These courses will also count toward the DPD sequence requirements at NYU should the student continue in that program after completing her BA degree.



An important focus of SCW is to educate the next generation of Jewish women for leadership positions in their professions and communities. Our commitment to the YU mission of *Torah U'Madda* is mirrored in the daily lifestyles of our students and thereafter in their future roles as professionals. Stern College students have academic strengths in both general and Jewish studies; the fusion of these worlds is evident in the student publication, *Derech HaTeva, a Journal of Torah and Science.* This SCW publication is distributed nationally and internationally and has received much praise for its level of Torah/science scholarship (see "*Derech HaTeva*," for a listing of articles that appeared in volumes 1 through 25).

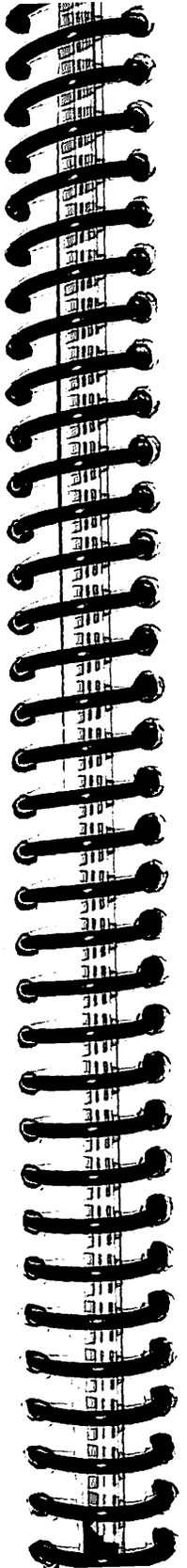
Specific faculty members are assigned roles to provide an intensive involvement in guiding students with their career choices and specifically in assisting with the application process. Dr. Brenda Loewy, director of the Office of PreHealth Advisement, has been joined by Dr. Chaya Rapp, to assist those students interested in careers in medicine, dentistry, optometry, veterinary medicine, and pharmacy. Mr. Jeffrey Mollin's focus is those students interested in careers in physical therapy, occupational therapy, physician assistant, nursing, and nutrition and Dr. Harvey Babich assists those interesting in a career in genetic counseling.

In the Fall semester, 2012, SCW alumni, now medical students in AECOM, initiated The Stern-Einstein Mentorship Program (affectionately known as the "Big Sister Mentor Program"). The intent of this program was to connect pre-med or pre-health undergraduates with SCW alumni at AECOM, who will guide the undergraduates in the medical school application and interview processes, as well to be available to answer simple questions that will save time and prevent unnecessary frustration. This program is now beginning its fourth year and has met with much success.

Dr. Loewy organized several seminars in which the guest speakers provided valuable insights into the various professions, as well as information on the admissions process to their graduate and professional programs. This past year, the SCW and Yeshiva College (YC) pre-med clubs organized the annual Medical/Dental School Fair in which admission directors and officers from allopathic and osteopathic medical schools, as well as from American medical student programs in Israel, and Dental Schools attended. The location of the annual fair is alternated between the Wilf

Campus (YC) and Beren Campus (SCW); this past year it was held at the Beren Campus. Each school had its own booth, thereby allowing students to approach the representative and to ask questions and gain insight into the school. This year, the following schools were present at the fair: representing the American Allopathic Medical Schools were Hofstra, Stony Brook, Rutgers; representing the American Osteopathic Medical Schools were NYITCOM and TouroCOM; representing the Israel American Medical Student Programs were Sackler, and Ben Gurion, representing the Dental Schools were NYU and Univ of Pennsylvania. Also in attendance were Touro College of Pharmacy and New York College of Podiatric Medicine.

In the 2011-2012 academic year, Dean Karen Bacon initiated the "Deans' Scholars Academic Enrichment Program." This Program offers those outstanding students in Yeshiva University's undergraduate schools an opportunity to participate in one of three cooperative programs. The program of particular interest to science majors is the "Frontiers in Biomedical Science: Theory and Practice." This project is under the direction of Dr. Edward Burns, Executive Dean of the Albert Einstein College of Medicine. The seminar meets six Fridays during the semester at AECOM and features leading biomedical scientists and their research. A second program, "Frontiers in Contemporary American Law," is under the direction of Vice Dean Melanie Leslie of Yeshiva University's Benjamin N. Cardozo School of Law. This exciting enrichment program meets at Cardozo School of Law six Fridays during the Spring semester for two hour sessions and is led by Cardozo faculty. Scholars discuss the ways that the U.S. legal system resolves disputes and addresses fundamental questions of justice through legal reasoning and processes. The third program is Frontiers in Psychology. This enrichment program, organized in conjunction with Dean Lawrence Siegel of Yeshiva University's Ferkauf Graduate School of Psychology, is an undergraduate program at the Ferkauf Campus. Scholars attend two-hour Friday seminars six times during the semester, led by Ferkauf faculty during the Fall semester on campus. The program aims to expose students to a spectrum of fields and specialties within psychology and to show students how the field's practitioners evaluate and address current societal issues using the science of psychology.



Department of Biology

Faculty: Anya Alayev, Ph.D.; Harvey Babich, Ph.D.; Bill Bassman, M.S.; John Golin, Ph.D.; Brenda Loewy, Ph.D.; Jeffrey Mollin, M. Phil.; Jennifer Odien, Ph.D.; Alyssa Schuck, Ph.D.; Margarita Vigodner, Ph.D.; Richard Weiss, M.D.

The Department of Biology offers a wide range of courses providing students with a thorough grounding in the fundamentals of modern biology, as well as exposing them to the cutting-edge areas of biomedical research. Course offerings include Cancer Biology, Cell Biology, Genetics, Human Anatomy, Human Development, Human Physiology, Immunology, Kinesiology, Medical Biochemistry, Microbiology, Molecular Biology, Musculoskeletal System, Neurobiology, Nutrition, Pharmacology, and Reproductive Biology, as well as Journal Club.

The Biology Department offers 3 tracks leading to a B.A. in Biology. Track #1 is the traditional course load for a B.A. in biology offered and requires completion of Principles of Biology I and II and 20 credits of advanced courses in Biology, of which four of the courses must be 4-credit lecture/laboratory courses. Also offered by the Biology Department are rigorous programs focusing on a concentration in "molecular and cellular biology" (track #2) and on a "concentration in neurobiology." Upon completion of the appropriate track of study, either the phrase "concentration in cell and molecular biology" or the phrase "concentration in the neurosciences" is noted on the college transcript. To accommodate the science requirements for non-science majors, the 3-credit course, Human Genetics, is offered. Beginning Spring semester, 2015, a Journal Club course was incorporated into the offerings in the Biology Department. Journal Club courses are taught by Stern alumni, usually 4th year med students at Albert Einstein College of Medicine (AECOM) or doctoral students in the Ph.D. program at Sue Golding Graduate Division of Biomedical Sciences, AECOM. The topics of the Journal Club course are varied and have included "Infectious Diseases and Vaccinations," "Preventive Medicine," Women's Health: Epidemiology Studies," "Oncology," "Immunology and Disease," and "Biomechanics."

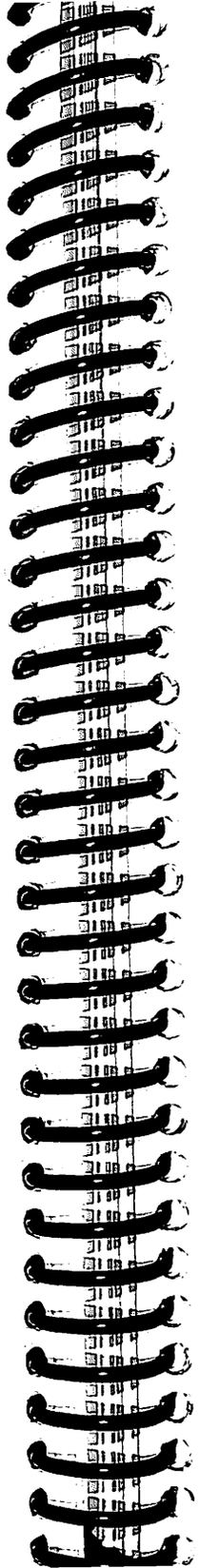
Dr. Brenda Loewy, a faculty member of the Biology Department and the recipient of the 2008, Dean Karen Bacon Award for a Senior Facul-

ty Member, is the college's Pre-Health Advisor. Her directive is to guide students interested in medicine, dentistry, optometry, and podiatry through the application process. To accomplish these goals, Dr. Loewy organizes a series of wide-ranging seminars. The overwhelming number of students interested in medicine, dentistry, and optometry, necessitated the recruiting of Dr. Chaya Rapp, Department of Chemistry and Biochemistry, to join the **Office of Pre-Health Advisement**. An important addition to the pre-health advisement staff was the appointment of Mr. Jeffrey Mollin, a member of the Biology Department, to guide students with career goals in nursing, physical therapy, occupational therapy, and physician assistant. Mr. Mollin was the recipient of the 2017 Dean Karen Bacon Award for a Senior Faculty Member. Dr. Harvey Babich guides those undergraduates interested in a career as a genetic counselor. Dr. Alyssa Schuck, faculty member of the Biology Department, heads the **Jewish Foundation for Education of Women (JFEW) Science Fellowship** and guides students participating in this program. Dr. Schuck was selected as the Senior Class Professor of the Year, 2013, 2014, 2016, and 2018 and the Professor Recognition Award for General Studies in May, 2019. In 2016, Dr. Schuck received the Dean Karen Bacon Faculty Award.

Volume 25 of ***Derech HaTeva. A Journal of Torah and Science***, was published in the Spring semester, 2021. This issue included manuscripts authored by 10 undergraduates, as well as the article, "Is there a place for prehistoric man within the Torah? The view of one European *gadol*, Rabb Israel Lipschitz," by Dr. Babich. In the Spring semester, 2019, Dr. Babich was a recipient of the Senior Class Professor Award of graduating class of May, 2019.

Faculty of the Biology Department initiated the Emergency Medical Technician Training Program for pre-health SCW and Yeshiva College (YC) undergraduates, along with the formation of the SCW-EMS and the YU-EMS. An $8,000 scholarship is awarded to students in need of financial assistance. The EMS is operating as an extension of *Ezras Nashim* volunteer emergency response service; the on-campus EMS became operational May, 2019.

Dr. Margarita Vigodner, Professor of Biology, and Dr. Anya Alayev, a Clinical Assistant Professor of Biology, have put the Biology Department on the "research map," as attested by their record of **publishing scientific research manuscripts** in prestigious scientific journals. Dr. Vigodner holds a secondary appointment at the rank of Assistant Professor in the Developmental and Molecular Biology at AECOM.

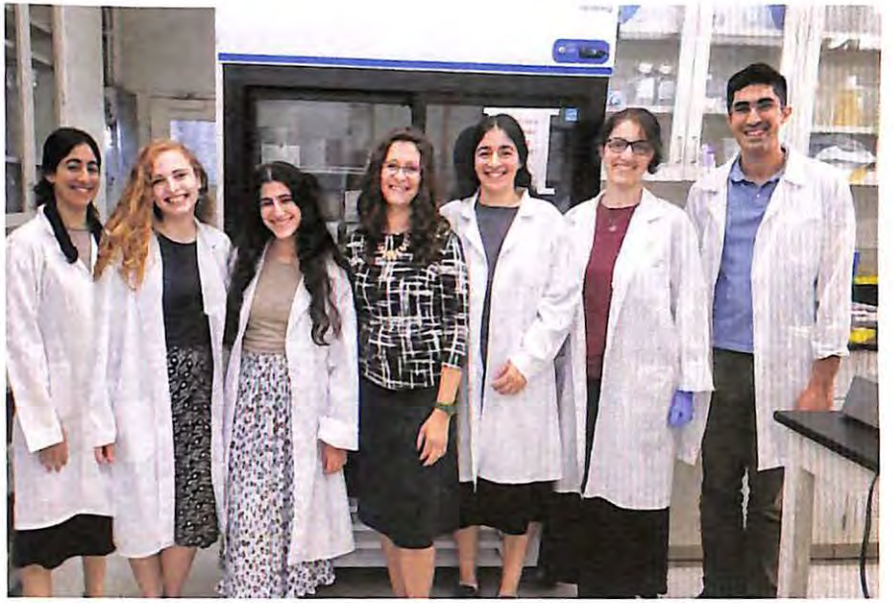


Dr. Vigodner's **past research** support included the NIH, NICHD: Academic Research Enhancement Award 1R15HD067944-01A1; "Regulation of Spermatogenesis by sumoylation;" extended until 1/11/2015 as an NIH; NICHD Administrative Supplements to Recover Losses Due to Hurricane Sandy. Through support by the Mitrani Foundation, in the Summer, 2015, the Vigodner laboratory was fully renovated. In addition, the Mitrani Foundation provided a small grant to support student research. **In June, 2019, the Biology Department was extremely proud to congratulate Professor Vigodner on receiving a 3-year R15 grant in the amount of $450,000 from the Eunice Kennedy Shriver National Institute of Child Health and Human Development.** The title of the research project is "Cell-type specific inactivation of sumoylation during mouse spermatogenesis." In the Fall semester, 2018, Dr. Vigodner was awarded the Doris and Ira Kukin Chair in Biology. In 2020, Dr. Vigodner authored the manuscript, "Identification of sumoylated targets in proliferating mouse spermatogonia and human testicular seminomas, Asian J. Urol., 22:569-577; T. Schwartz and R. Levy, SCW undergraduates, were listed as coauthors. Dr. Anya Alayev oversees the NIH grant, 1R15CA220021-01: "Targeting Estrogen Related Receptor alpha in triple negative breast cancer. She presented an abstract of her research as the 2021 AACR annual meeting, entitled "Ras-Raf-MEK-ERK signaling pathway: A novel target of ERRα and tamoxifen in TNBC cells," and authored by David Musheyev, ***Adi Ronen***, ***Miriam Lattin***, and Anya Alayev (underlined names are SCW undergraduates). Dr. Alayev is on the advisory board for JOWMA - Jewish Orthodox Women's Medical Association. Dr. Alyssa Schuck's research interests involve the response of human oral cancer cells to nutraceuticals.

Drs. Vigodner, Alayev, and Schuck actively recruit SCW undergraduates to join their research. The focus on cutting-edge research by the Biology faculty has been the driving force in the publication of numerous manuscripts in peer-reviewed scientific journals. The college has confidence in the continued excellence of its research faculty and has recently invested funds for the purchase of a camera for Dr. Vigodner's epifluorescence Nikon microscope, as well as a Biorad gel documentation station.

For the Alayev lab, the following items were purchased: an upright freezer, a sliding door refrigerator, an upright fridge/freezer, an Eppendorf 4oC benchtop centrifuge, and a Keyence microscope with fluorescence.

The Vigodner Lab (summer, 2021). Tania Kiesel (SCW), Manveet Nanda (Katz School, YU, biotechnology program), Kayla Perlmutter (SCW), Dr. Amitabha Sengupta (Research Associate), Shanza Baser Tariq (Katz School, YU, biotechnology program), and Dr. Margarita Vigodner (PI)



The Alayev Lab (summer 2021). Esther Miller (SCW), Shana Erblich (Rutgers Univ.), Rachel Khaimchayev (Aldephi Univ.), Dr. Anya Alayev (PI), Elisheva Miller (SCW), Natania Birnbaum (SCW), and David Musheyev, M.D. (post-doctoral fellow).

To put the pandemic behind us, on July 26, 2021, the Biology Department sponsored the seminar, "Post-Covid-19 Summer, 2021 Symposium on Undergraduate Research." Summer research interns, both in SCW and in Yeshiva College, participated in a joint program focusing on individual research accomplishments. The student presenters included: Kayla Perlmutter, Tania Kiesel (the Vigodner Lab, SCW), Elisheva Miller, Esther Miller, Natania Birnbaum (the Alayev Lab, SCW), Michael Gerber, ,Avishai Samouha (the Maitra Lab, YC), Nicole Soussana, Jeremy Purow, Eliezer Heller (the Steinhauer Lab, YC), Asher Junger (the Murthi Lab, YC) and Maayan Hirschkorn (the Rusk Institute for Rehabilitative Medicine). Also presenting were Shanza Baseer Tariq and Manveet Nanda (Katz School, YU).

Department of Chemistry and Biochemistry

James Camara, Ph.D., Jinzi Deng, Ph.D; Ran Drori, Ph.D; Donald Estes, Ph.D.; Jianfeng Jiang, Ph.D.; Chaya Rapp, Ph.D.; Rosalyn Strauss, Ph.D.

In keeping with the approach to science education at SCW, the Department of Chemistry and Biochemistry offers a series of high level courses, opportunities for undergraduate research, and extracurricular programming to foster an enthusiasm for science and an interest in scientific research.

The Department of Chemistry and Biochemistry offers majors in both Chemistry and Biochemistry. In fall of 2019, the Biochemistry major was revised and updated. A new course, called Biochemistry and Molecular Biology was added to provide students with a more focused and thorough background in Biochemistry. The Biochemistry major is rigorous and attracts a talented and motivated group of students, particularly those headed to medical school or Ph.D. programs in the sciences.

Graduates of the Chemistry and Biochemistry majors have gone on to medical, dental, optometry, and law schools, and careers in science education. Several have entered prestigious Ph.D. programs in the biomedical sciences, at the Tri-institutional Weil Cornell/Rockefeller/Sloan Kettering program, Sloan Kettering graduate program, and the Sue Golding graduate division of the Albert Einstein College of Medicine (AECOM).

The courses in our department are continuously being updated to keep pace with current scientific discovery and new technology. In our Honors General Chemistry course, students read articles from current scientific literature related to course content. Courses in analytical chemistry and biochemistry incorporate experiments that are related to the instructors' research interests allowing content to be taught in the context of current, cutting edge, and biologically relevant research. State of the art instrumentation including a nuclear magnetic resonance spectrometer, an automatic titrator, a multimode plate reader, data acquisition software and probes, and molecular modeling software, have been integrated into laboratory courses on all levels so that our students are trained in the use of current laboratory technology. The department also offers a Science Fundamentals course which is popular among students pursuing education or business degrees, and a Chemistry for non-majors course which serves students entering the allied health fields. These courses focus on chemistry as it relates to the world around us and contemporary environmental issues.

The Drori laboratory's main focus is the study of ice-binding proteins (or antifreeze proteins), which aid a variety of organisms to survive in subfreez-ing temperatures. A unique combination of sensitive temperature control and a fluidic system allows for the cutting-edge capability to study the in-teraction of molecules with microscopic ice crystals. This advanced instru-mentation is coupled with a collaboration with researchers from Canada, the Netherlands and the US, who supplied the purified antifreeze proteins. A recent research paper, published in the Journal of Physical Chemistry B, studied the acceleration of ice growth by antifreeze proteins and in-cluded an undergraduate student in the authors list (Elana Apfelbaum). Another manuscript is currently under review in the journal *ChemPhy-sChem* and includes a student author (Tamar Soussana). During the 2020-2021 school year, 4 students have been working in the Drori lab, includ-ing Atara Neugroschl, who·recevied the 2021 Kressel award, and Tamar Soussana, who presented her poster at the national ACS meeting (virtual).

The department supports extra-curricular activities that enhance student interest and appreciation of chemistry and science in general, both on campus and in the broader community. The Stern College Chemistry Club is a student affiliate of the American Chemistry society and is advised by Don Estes and Chaya Rapp. The club received an Honorable Mention Chapter Award for its 2019-2020 activities from the American Chemical Society. In addition to hosting several events on food chemistry, the club's theme for the year, the club members attended a virtual outreach program at the New York Hall of Science and hosted a virtual career panel discussing careers in industry and research for chemistry/biochemistry majors. Below, students gather in-person for an event where a chemist speaks about flavor chemistry and host a zoom meet discussing careers.

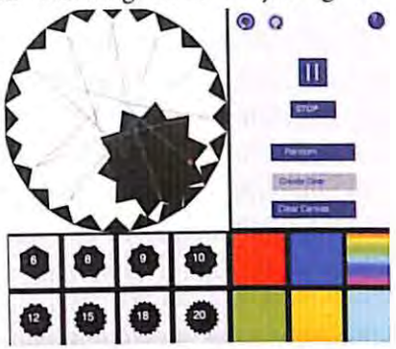
Department of Computer Science

Chair: Alan Broder, Clinical Professor
Joshua Waxman, Assistant Professor
Ari Shamash, Adjunct Assistant Professor
Lawrence Teitelman, Clinical Assistant Professor

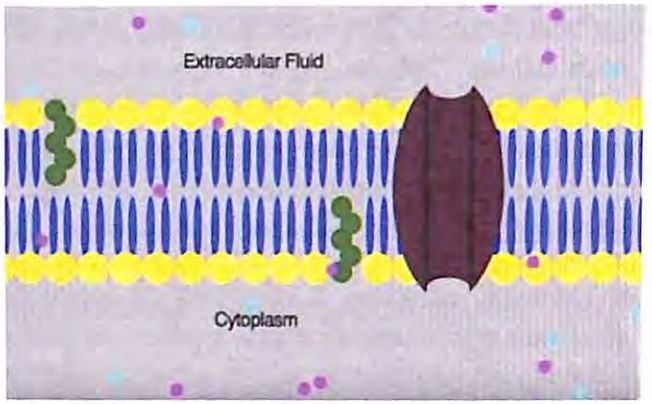
The Computer Science program at Stern College for Women stresses both the practical and theoretical aspects of computing, preparing students for employment in various fields of computer science and to pursue graduate studies. There is a strong emphasis in the department on preparation for challenging jobs in industry – our faculty and adjuncts come from positions of intensive industrial experience and leadership. In addition to covering fundamentals of Computer Science theory and practice, the department strives to help students maximize their portfolios of significant coding projects, via course requirements and through extracurricular activities such as hackathons and internships.

For highlights of a few notable semester capstone projects from our COMP 1300 – Introduction to Computer Science course see the screen shots below, and the video at http://demoreel.sterncs.net/

While these projects seem to be just games, the video demonstrates how much can be accomplished in just a first semester of CS. The semester projects are an inspirational stepping stone to further CS learning, and indeed many of our COMP 1300 students move on to more advanced learning and majoring in Computer Science.



Spirograph Simulator
Tzirliya Plotkin



Simulation of Diffusion Across a Cell Membrane
Tova Narrowe

In the CS degree program, students gain experience with a variety of programming languages including Python, Java, Javascript, R, Go, and C/C++, while learning how to develop applications for Linux, web, and cloud platforms such as Hadoop and Spark.

In 2018, the CS department was the recipient of major private and public grants to build a collaboration lab and technology classrooms for Computer Science students at the Beren campus. The new spaces, operational in the Fall of 2021, emulate similar collaboration spaces in top technology companies, including floor-to-ceiling writable and projectable glass walls, flexible furnishings, and large screen displays.

The new Mitrani collaboration lab – Fall 2021
(architect rendering)

Stern's Computer Science program is ideally situated near the heart of Manhattan's "Silicon Alley", convenient to recruiters from major financial and tech employers. Stern Computer Science students have recently been sought and hired for internships and post-graduation employment by premiere employers such as Microsoft, Palantir, Facebook, Goldman Sachs, Amazon, Naval Research Laboratory, MITRE, JPMorgan, UBS, Nomura, Avvir, TD Bank, Broadridge, Avanade, and Google.

The department also offers the Professor Thomas Otway Memorial Scholarship for exceptional students who choose Computer Science as their major, established in memory of the beloved Professor.

Students in the department run a chapter of ACM-W, the international Association of Computing Machinery - Women's division. In 2019, Stern ACM-W members ran a "tech Shabbat" bringing together CS students and Stern faculty for community building and tech-themed Torah learning. Stern students are key members of the operation of the city-wide Invent YU hackathon, and have also been participants in the nationwide jHacks hackathon held at the University of Maryland Hillel.

The ACM-W chapter also offers frequent events throughout the year, such as guest lecturers by computer scientists from prominent companies, resume workshops, networking events, and coding practice sessions. Stern CS students are committed to helping other women develop as computer scientists, and frequently serve as peer tutors and teaching assistants in the department, they volunteer at local high schools, and are leaders of high school tech events.

High-achieving students in the S Daniel Abraham honors program will also benefit from an enriched CS educational experience. As part of the honors program, students complete an honors research program and thesis with the mentorship of a CS department faculty member.

Department of Physics

Mark Edelman, Ph.D., Clinical Associate Professor
Emil Prodan, Ph.D., Professor
Lea Ferreira dos Santos, Ph.D., Professor

The Physics Department at Stern College for Women (SCW) aims at educating its students of education through research. All faculties pursue an active research agenda, being constantly invited to present their findings in conferences and workshops, and having their articles published in prestigious scientific journals. Their works have been highlighted on several occasions and awarded major research grants. The exposure to such cutting-edge science and the atmosphere of discovery both play a major role in the formation of our undergraduate students and their future career plans.

Stern College students who are interested in physics, physical sciences or engineering have several opportunities to actively participate in faculty research. The Physics Department is always seeking new students interested in doing first class research. They can choose from a variety of projects and work under the guidance of the physics department members. Stern physics students undertake research during the summers and throughout the year. They are co-authors in wrefereed articles published in physics, chemistry, and materials science journals, and they present their results at national and international science meetings.

Below are the highlights of our Physics Department (2020-2021):

Summary of Research (2020-2021)
3 grants (2 NSF,1 Simons Foundation): US$ 872,476
29 peer-reviewed articles
34 invited talks + 4 contributed talks by Stern students
2 organized conferences
1 postdoctoral fellow
8 research undergraduate students
1 honor thesis; 1 Kressel scholar

(a) Dr. Mark Edelman

Publications

1) M. Edelman, "Evolution of Systems with Power-Law Memory: Do We Have to Die? (Dedicated to the Memory of Valentin Afraimovich)" in C. H. Skiadas and C. Skiadas (eds.), *Demography of Population Health, Aging and Health Expenditures,* 65-85, Springer, August 23, 2020.

2) M. Edelman, "Cycles in Asymptotically Stable and Chaotic Fractional Maps", Nonlinear Dynamics, https://doi.org/10.1007/s11071-021-06379-2, 2021; ariv:2010.12924.

Invited talks

1. May 25-25, 2021; International joint meeting on Recent Advances in Nonlinear Science Marseille, France (online) (https://nscct20.sciencesconf.org/program); Plenary talk "Cycles in integrable and chaotic fractional systems".
2. March 20-21 AMS Spring Eastern Sectional Meeting. Co-organizer and moderator of the Special Session on Fractional Calculus and Fractional Differential/Difference Equations. 50 min talk: "Chaos and asymptotically cyclic sinks in fractional maps". https://www.ams.org/meetings/sectional/2284_program_ss19.html#title
3. March 15–19, 2021, APS March Meeting, Session L14: Evolutionary and Ecological Dynamics; M. Edelman and R. Jacobi, Oral presentation "Power-Law Memory in Living Species and the Distribution of Lifespans".
4. Nov 23-25, 2020, The 1st Online Conference on Nonlinear Dynamics and Complexity (http://ndc.lhscientificpublishing.com/), Invited talk "Stability of discrete fractional systems and lifespan of living species".
5. Nov 22, Co-organizer of the on-line mini-symposium Discrete Fractional Dynamics and Its Applications (http://ndc.lhscientificpublishing.com/program/, Symposium 10), The introductory talk "Asymptotically cyclic sinks of fractional maps".
6. Jun 9-12, 2020; 13th CHAOS 2020 International Conference, Florence, Italy (online) (http://www.cmsim.org/committeesplenary2020.html), Plenary talk "Evolution of Systems with Power-Law Memory: Do We Have to Die?"

Editorial Boards

Fractional Calculus and Applied Analysis
Journal of Applied Nonlinear Dynamics.
Communications in Nonlinear Science and Numerical Simulations.
Fractal and Fractional

Students involved in research

1. Rachel Jacobi
2. Jonathan Mamet
3. Avigayil Helman
4. Chaya Meltzer

Students' presentations

March 15–19, 2021, APS March Meeting, Session L14: Evolutionary and Ecological Dynamics; M. Edelman and R. Jacobi, Oral presentation "Power-Law Memory in Living Species and the Distribution of Lifespans".

(b) Dr. Emil Prodan

External funding

Funder:	National Science Foundation (DMR 1823800)
Period:	01/09/2019-01/09/2021
Title:	Topological Aperiodic Materials and Meta-Materials
Amount:	$378,000

Peer-reviewed articles

(total of 8 published articles, 2 Phys. Rev. Lett and 1 Comm Physics)

1) M. Rosa, M. Ruzzene, E. Prodan, Topological gaps by twisting, in press Communications Physics (2021).

2) E. Prodan, Fermionic Topological Order on Triangulations, Annals of Henri Poincare 22, 1133–1161 (2021).

3)T. D. Kühne, J. Heske, E. Prodan, Disordered Crystals from First Principles II: Transport Coefficients, Annals of Physics 421, 168290 (2020).

4) W. Cheng, E. Prodan, C. Prodan, Experimental demonstration of dynamic topological pumping across incommensurate acoustic meta-crystals, Phys. Rev. Lett. 125, 224301 (2020).

5) Y. Liu, E. Prodan, A Computer Code for Topological Quantum Spin Systems over Triangulated Surfaces, International Journal of Modern Physics C 31, 2050091 (2020).

6) Y. Liu, Y. Liu, E. Prodan, Braiding Flux-Tubes in Topological Quantum and Classical Lattice Models from Class-D, Annals of Physics 414, 168089 (2020).

7) Y. Barlas, E. Prodan, Topological braiding of Majorana-like modes in classical meta materials, Phys. Rev. Lett. 124, 146801 (2020).

8) B. Leung, E. Prodan, Bulk-Boundary Correspondence for Topological Insulators with Quantized Magneto-Electric Effect, J. Phys. A: Math. Theor. 53, 205203 (2020).

Organized conference

1)"C*-algebras, K-theories and Noncommutative Geometries of Correlated Condensed Matter Systems," Simons Center for Geometry and Physics (May 2021).

Invited talks

9. 'Topological Insulators at Strong Disorder,' lecture for the international seminar series Noncommutative Geometry and Physics, March 2021.

8. 'Phason engineering for topological wave steering,' lecture for the international MetaMat seminar series, Jan 2021.

7. 'Noncommutative Geometry and Materials Science,' lecture for the Global Noncommutative Geometry seminar, Jan 2021.

6. 'Discovery in Materials Science via K-Theory and Non-Commutative Geometry,' lecture for YU Mathematical Physics seminar, New York, Oct 2020.

5. 'Innovation in Materials Science via K-Theory and Non-Commutative Geometry,' TopDyn Workshop organized by PetaSpin, Rome, Oct 2020.

4. 'Index Theorems in KK-Theory,' online lecture for the NYC Non-Commutative Geometry Seminars, New York, June 2020.

3. 'Cyclic co-homology, Fredholm modules, Kasparov's generalizations,

online lecture for the NYC Non-Commutative Geometry Seminars, New York, May 2020.

'2. The C*-algebra of equivariant Hamiltonians over point patterns,' online lecture for the NYC Non-Commutative Geometry Seminars, New York, May 2020.

1. 'On the Non-Commutative Geometry of Topological Insulators and Superconductors,' lecture for the Joint Mathematics Meetings of the American Mathematical Society, Denver, Jan. 2020.

(c) Dr. Lea F. Santos

External Funding

Funder: National Science Foundation (DMR - 1936006)
Period: 01/01/2020-12/31/2022
Title: Nonequilibrium Quantum Matter: Timescales and Self-Averaging
Amount: $400,000

Funder: Simons Foundation (678586)
Period: 01/01/2021-08/31/2021
Title: Nonequilibrium Quantum Dynamics of Many-Body Systems
Amount: $ 94,476

Peer-reviewed articles

(total of 19 articles, 1 Nature Physics, 1 Nature Communications)

19) Quantum-classical correspondence of a system of interacting bosons in a triple-well potential
E. R. Castro, J. Chavez, I. Roditi, Lea F. Santos, J. Hirsch
arXiv:2105.10515

18) Heating suppression by long-range interactions in periodically driven spin chains
Devendra Singh Bhakuni, Lea F. Santos, and Yevgeny Bar Lev
arXiv:2105.09959

17) Probing the edge between integrability and quantum chaos in interacting few-atom systems
Thomás Fogarty, Miguel Angel Garcia-March, Lea F. Santos, N.L. Harshman

arXiv:2104.12934

16) Equilibration time in many-body quantum systems
TLM Lezama, EJ Torres-Herrera, F Pérez-Bernal, YB Lev, Lea F Santos
arXiv:2102.11882

15) Multifractality and self-averaging at the many-body localization transition
A Solórzano, Lea F Santos, EJ Torres-Herrera
arXiv:2102.02824

14) How many particles make up a chaotic many-body quantum system?
G Zisling, LF Santos, YB Lev
SciPost Physics 10, 088 (2021)

13) Lea F Santos
The quick drive to pseudo-equilibrium
Nature Physics **17**, 429 (2021)

12) S Pilatowsky-Cameo, D Villaseñor, MA Bastarrachea-Magnani, Sergio Lerma-Hernández, Lea F Santos, Jorge G Hirsch
Ubiquitous quantum scarring does not prevent ergodicity
Nature Communications **12,** 852 (2021)

11) M Niknam, Lea F Santos, DG Cory
Experimental Detection of the Correlation Rényi Entropy in the Central Spin Model
arXiv:2011.13948

10) Y Liu, Lea F Santos, E Prodan
Topological Gaps in Quasi-Periodic Spin Chains: A Numerical and K-Theoretic Analysis
arXiv:2009.03752

9) S Pilatowsky-Cameo, D Villaseñor, MA Bastarrachea-Magnani, Sergio Lerma-Hernández, Lea F Santos, Jorge G Hirsch
Quantum scarring in a spin-boson system: fundamental families of periodic orbits
New Journal of Physics, **23** 033045 (2021)

8) EJ Torres-Herrera, I Vallejo-Fabila, AJ Martínez-Mendoza, Lea F Santos
Self-averaging in many-body quantum systems out of equilibrium: Time dependence of distributions

Physical Review E **102**, 062126 (2020)

7) Lea F Santos, F Pérez-Bernal, EJ Torres-Herrera
Speck of chaos
Physical Review Research **2**, 043034 (2020)

6) EJ Torres-Herrera, G De Tomasi, M Schiulaz, F Pérez-Bernal, LF Santos
Self-averaging in many-body quantum systems out of equilibrium: Approach to the localized phase
Physical Review B **102**, 094310 (2020).

5) M Schiulaz, EJ Torres-Herrera, F Pérez-Bernal, LF Santos
Self-averaging in many-body quantum systems out of equilibrium: Chaotic Systems
Physical Review B **101**, 174312 (2020).

4) D Villasenor, S Pilatowsky-Cameo, MA Bastarrachea-Magnani, Sergio Lerma-Hernández, Lea F Santos, Jorge G Hirsch
Quantum vs classical dynamics in a spin-boson system: manifestations of spectral correlations and scarring
New Journal of Physics **22**, 063036 (2020)

3) EJ Torres-Herrera, LF Santos
Dynamical Detection of Level Repulsion in the One-Particle Aubry-André Model
Condensed Matter 5, 7 (2020) [in memory of Shmuel Fishman]

2) S Pilatowsky-Cameo, J Chávez-Carlos, MA Bastarrachea-Magnani, Pavel Stránský, Sergio Lerma-Hernández, Lea F Santos, Jorge G Hirsch
Positive quantum Lyapunov exponents in experimental systems with a regular classical limit
Physical Review E 101, 010202 (R) (2020)

1) M Niknam, LF Santos, DG Cory
Sensitivity of quantum information to environment perturbations measured with a nonlocal out-of-time-order correlation function,
Physical Review R **2**, 013200 (2020)

Organized Conference and Program
Workshop Ergodicity and chaos in many-body systems (UNAM, Mexico, Feb/4-7, 2021)

Editorial Boards

-New Journal of Physics
-Physical Review E

Awards

-Simons Fellow in Theoretical Physics (2021)

Invited Talks

19) Online: FQMT 21 (Prague, Czech Republic, July/18-24, 2021)
18) Online: University of Luxembourg (June/28, 2021)
17) Online: Les Houches School in Computational Physics: "Dynamics of Complex Systems, from Theory to Computation" (April/12-23, 2021)
16) Online: Perimeter Institute (Waterloo, Canada, Mar/24, 2021)
15) Online: Jozef Stefan Institute and the Department of Physics of the University of Ljubljana (Mar/23, 2021)
14) Online: Ben Gurion University (Israel, Mar/22, 2021)
13) Online: Emory University (Atlanta, Feb/17, 2021)
12) Online: Instituto Técnico de Lisboa (Lisboa, Portugal, Feb/ 2021)
11) Online: The Royal Society (London, UK, Feb/8-11, 2021)
10) Online Workshop Ergodicity and chaos in many-body systems (UNAM, Mexico, Feb/4-7, 2021)
9) Online: Universität Bielefeld (Germany, Jan/14, 2021)
8) Online: Federal University of Rio Grande do Norte, Brazil (Dec/10, 2020)
7) Online: Wesleyan University, USA (Dec/02, 2020)
6) Online workshop on Chaos in many-body quantum systems, The Graduate Center of CUNY (Oct/02, 2020)
5) Online colloquium at the Federal University of São Carlos, Brazil (Sep/15, 2020)
4) Online: QChaos 2020 (Aug/13, 2020)
3) Online Workshop on Transport in 1d quantum-lattice models (Jul/10, 2020)
2) Colloquium at Emory University
(Atlanta, GA, USA, Feb/18, 2020)
1) Workshop: Equilibration and Thermalization in Finite Quantum Systems (UNAM, Mexico, Jan/20-25, 2020)

Postdoctoral Fellow:

Talía Lezama is joining SCW in September 2021

Students' Presentations:

Eliana Feifel: APS March Meeting, Boston (March 2021)
Chemda Wiener: APS March Meeting, Denver (March 2021)

Students Supervised

-Eliana Feifel
-Chemda Wiener
-Tamar Leiser
-Leon Alper

Honors Thesis

-Chemda Wiener

Kressel Scholar

-Tamar Leiser (2020-2021)

Department of Mathematical Sciences

Faculty: Edward Belbruno, Ph.D.; Wenxiong Chen, Ph.D.; Michael Dalezman, Ph.D.; Marian Gidea, Ph.D. (Chair); Antonella Marini, Ph.D.; Morton Lowengrub, Ph.D.; Pablo Roldan, Ph.D.
Visiting Professor: Mina Teicher, PhD, Bar Ilan University.
Affiliate, Quantitative Finance: Yuri Katz, Ph.D.
Affiliates, Physics: Neer Asherie, Ph.D.; Sergey Buldyrev, Ph.D.; Gabriel Cwillich, Ph.D.; Mark Edelman, Ph.D.; Emil Prodan, Ph.D.; Lea Santos, Ph.D., Fredy Zypman, Ph.D.

Mathematics is crucial to the advancement of all other disciplines: biology, medicine, astronomy, robotics, communications, finance, security, technology, and computer science. Students majoring in mathematics enjoy a variety of job opportunities, such as actuaries, computer scientists, quantitative analysts, researchers, teachers and academics. Many other fields that require applied science and technology frequently hire people with a strong mathematical background. This versatility lends itself to a job seeker's market, and the result is a high average annual salary. Professions in mathematics top the best "jobs of tomorrow", in a ranking based on hiring outlook, stress, environment, and income.

The Stern College Department of Mathematical Sciences is leading the way in Yeshiva University's efforts prepare its students for the marketplace of tomorrow. Our mathematics courses provide students with key knowledge in theoretical and applied mathematics, and help them enhance their analytical abilities and heighten their creative potential. Students in the mathematics program have the opportunity to choose a concentration in Pre-Actuarial/Financial Mathematics. Advanced coursework is focused on modern mathematics, including differential equations, probability and statistics, mathematics of finance, time series, scientific computing, data analysis, network science, mathematical biology, and chaos theory. In addition to coursework, students may participate in research projects focuses on specific areas of practice, or industrial applications, under the guidance of highly active research faculty or industry mentors. There is variety of enrichment activities organized at Stern College, including the math club "No Limits", Mathematical Colloquia, and citywide seminars in Dynamical Systems and/or Mathematical Physics, which include speakers from around the world.

In addition to an undergraduate degree, the department offers an MA program, as well as a PhD program in Mathematics. An excellent option for math students is the BA/MA program, where qualified undergraduate students can take math graduate classes, and receive up to 12 credit hours of graduate courses towards the BA degree.

Our courses are taught by distinguished faculty with a tradition of excellence in teaching, mentoring, and research. Below are some highlights on our faculty research:

- Prof. Belbruno is the recipient of Humboldt Research Award in 2017, awarded by the Alexander von Humboldt Stiftung/foundation of Germany for lifetime achievements. He designed space missions for NASA and other space agencies, and he created new mathematical models in cosmology, such as for the Big Bang and for black holes.
- Prof. Chen has made significant advances in the theory of nonlinear elliptic partial differential equations and geometric analysis.
- Prof. Dalezman has done research in the theory of prime numbers.
- Prof. Gidea provided a solution to a long standing open problem is mathematics, the Arnold diffusion conjecture.
- Prof. Katz employs methods rooted in the physics of complex non-equilibrium systems to perform credit risk modeling.
- Prof. Lowengrub is one of the fathers of the WIYN Observatory (Arizona), and a former vice-president of the Association of Universities for Research in Astronomy (AURA). The asteroid 4045 Lowengrub is named after him.
- In the scientific literature, the standard boundary conditions for gauge-invariant equations are called "Marini conditions" in honor of Prof. Marini's research in this area.
- Prof. Roldan developed a new mathematical theory to explain the existence of "Kirkwood gaps" in the Main Asteroid belt.
- Prof. Mina Teicher is an internationally renowned scientist, with a broad expertise in algebraic geometry, algebra, applied mathematics, and neuroscience. She is a faculty in the Department of Mathematics and in the Gonda Brain Research Center at Bar Ilan University (Tel Aviv), and the director of the Emmy Noether Institute for Mathematics. She is a VP of International Commission for Mathematical Instruction, a former VP for Research and Development at Bar-Ilan,

a former Chief Scientist, and a former chair of USA-Israel Binational Science Foundation.

- Several members of the faculty have written textbooks and monographs in their fields.
- Faculty research has been funded by National Science Foundations, National Aeronautics and Space Administration, National Institute of Health, National Cancer Institute, Simons Foundation, Sloan Foundation, Boeing Corporation, etc.
- Faculty members are frequently invited to lectures at major conferences and workshop in the US as well as other counties in America, Europe, Asia, and Africa.

Department of Psychology

Faculty: Joshua Bacon, Ph.D.; Lisa Chalik, Ph.D.; Terry DiLorenzo, Ph.D. (Chair); Rachel Ebner, Ph.D.; Rebecca Greif, Ph.D.

As a discipline, Psychology is generally categorized as a Social Science together with other fields such as Social Work, Political Science, Economics, and Sociology. However, scientific methodology and empirical research have always been a critical component of the coursework and extra-curricular opportunities offered by our department. Experimental Psychology, as a prerequisite for the majority of other courses offered, highlights the fundamental importance that we place on understanding the subject matter of psychology in the context of rigorous empirical analysis, research methodology, and scientific thinking. The Research Seminar, a course taken by psychology majors who are interested in pursuing a doctorate in Psychology, provides students with research opportunities and classroom instruction that advance their understanding of the application of research methodology to a "real world" setting. Some courses such as the Seminar in Intergroup Cognition, the Seminar in Moral Psychology, Cognition, Learning, and Psychobiology are rooted in the tradition of research and easily fit into the Science framework. Many other courses such as Social Psychology, Developmental Psychology, Personality, and Abnormal Psychology are brought into the arena of Science by faculty who are grounded in scientific methodology and all have active research programs.

In addition to the general psychology major, the department also offers a specialty track in Behavioral Neuroscience This Behavioral Neuroscience track option for Psychology majors provides a focused education to students who are interested in the biology behind human and animal behavior. In addition to the core courses that are required of all majors, further requirements and electives come from critical courses in Neuroscience, such as Cognitive Neuroscience, Behavioral Neuroendocrinology, and a Neurobiology lecture and lab.

Students who are planning to apply to Ph.D. or Psy.D. programs in Psychology or to pursue careers in other health-related fields such as Physical, Occupational, or Speech Therapy, are encouraged to become actively engaged in research. Students have gained invaluable experience outside

the classroom by learning about the fundamental role of research in the theory and practice of psychology by working with faculty members in projects off-campus such as with Dr Joshua Bacon in the M.S. Care Center at NYU. On campus, students have worked on research projects with Dr. Terry DiLorenzo focusing on health-related attitudes and cognitions and their relations to health behaviors and in Dr. Lisa Chalik's Developing Minds lab which investigates how children categorize people into social groups and the, inferences they make on the basis of social group membership . Many of the students who conducted research with our faculty have coauthored presentations at both national and international conferences.

For students whose interests lie in areas outside of those of the department, opportunities are available in a number of academic, hospital, and clinical settings. In this case, a faculty member may serve as a supervisor to maintain continuity of the student's experience as an integrated part of her program in psychology. Students engaged in research are encouraged to present their work at university-sponsored events and other professional meetings.

Below, we introduce the members of the Psychology Department and we look forward to the continued contributions of the Behavioral Sciences to Women in Science.

Dr. Joshua Bacon received his Ph.D. from NYU in 1976. During this time, he also conducted research at Swarthmore College with Dr. Hans Wallach, one of the last remaining students of Wolfgang Kohler, the founder of Gestalt Psychology. In 1976, Dr. Bacon obtained a position as Assistant Professor at Tufts University in Boston and received tenure in 1984. At that time, he was recruited by Yeshiva University and joined the Department of Psychology in 1984. He teaches basic courses in Experimental Psychology and Cognition, as well as the Cognitive Neuroscience course that is a basic requirement for the Behavioral Neuroscience track. Dr. Bacon's area of research is perception and cognition and, in particular, cognitive impairment and rehabilitation in patients with Multiple Sclerosis. He holds a position of Research Associate Professor in the Department of Neurology at the NYU Medical School and is a member of the clinical and research team in the Multiple Sclerosis Care Center of NYUHJD. He is currently working on a cognitive rehabilitation program for MS patients with cognitive impairments and is also the principle investigator of a project to develop a diagnostic battery that will measure subtle cognitive impairments that may emerge in the early stages of MS. Some of his recent studies have looked at the correlation between performance on one of the behavioral tests of cross hemisphere processing he developed and atrophy of the corpus callosum as seen on MRI scans. Undergraduate students from Stern College have been and continue to be involved in this research and have been coauthors on a number of poster presentations at conferences of the Academy of Neurology and of the Multiple Sclerosis Consortium.

Dr. Lisa Chalik received her Ph.D. in Psychology in 2016 from New York University, where she conducted research in the Conceptual Development and Social Cognition Lab and completed a concentration in Developmental Science. She then completed a postdoctoral fellowship at Yale University, where she worked in the Social Cognitive Development Lab and the Infant Cognition Center. In the Fall of 2018, she started as an Assistant Professor at Stern College for Women, where she teaches courses in Psychology and Development. She also founded and directs the Developing Minds Lab, the first ever psychology research lab on the SCW campus, where she mentors students who wish to receive first-hand experience conducting research in Developmental Psychology. Dr. Chalik's research area is social cognitive development; she focuses on the abstract theories that children build and rely upon as they navigate the social world. Specifically, she investigates how children learn to organize the people around them into social categories, and how they make inferences about people on the basis of social category membership. She also studies the implications of social categorization for moral evaluation. She has published her findings in a number of top Psychology journals and regularly presents at professional conferences, such as the Society for Research in Child Development and the Cognitive Development Society.

Dr. Terry DiLorenzo received a B.A. in psychology from Rutgers University and a Ph.D. in Health Psychology from Ferkauf Graduate School of Psychology of Yeshiva University. She completed a postdoctoral fellowship at Memorial Sloan-Kettering Cancer Center and then was the Director of Research of the Multiple Sclerosis Comprehensive Care Center of New York Medical College until she joined the Psychology Department of Stern College for Women in 1999. Since joining the Department, Dr. DiLorenzo has conducted several studies examining health-related atti-

tudes and cognitions and their relations to health behaviors. Dr. DiLorenzo has also conducted research on the psychometric properties of scales to assess mood and attitudes toward seeking health care. Dr. DiLorenzo also has an interest in sexual health behaviors and has completed a study on sexual health practices in Orthodox Jewish women. Dr. DiLorenzo has published her findings in articles in peer-reviewed journals and has presented at many professional meetings. In addition to her own research, Dr. DiLorenzo has mentored several honors students whose projects have been presented at professional meetings as well. Dr. DiLorenzo teaches several advanced courses including Human Sexuality, the Honor's Psychology Research Seminar, and Introduction to Public Health, in addition to Abnormal and Social Psychology. Dr. DiLorenzo also coordinates the recently developed Public Health Minor at Stern College.

Dr. Rachel Ebner received a Ph.D. in Educational Psychology from the CUNY Graduate Center, where she concentrated in Learning, Development, and Instruction. She also earned an Ed.M. in Prevention Science and Practice from the Harvard Graduate School of Education and an M.A. in Developmental Psychology from Columbia University's Teachers College. Her postdoctoral research has focused on devising and implementing methods to help students self-regulate their learning, especially when learning online. She has taught a variety of courses on child & adolescent development and educational psychology. In addition to teaching at Stern, she also serves as Yeshiva University's Director of Student Learning Assessment. She works with faculty and administrators on developing and supporting their programmatic learning assessment activities.

Dr. Rebecca Greif received a B.A. in psychology from Duke University and a Psy.D. in clinical psychology from the Rutgers Graduate School of Applied and Professional Psychology. She completed a postdoctoral fellowship at the Mount Sinai Eating and Weight Disorders Program, where she is an assistant professor. Dr. Greif's clinical expertise centers on the use of evidence-based treatments, in particular cognitive behavior therapy and dialectical behavior therapy, for adults with mood disorders, anxiety disorders, and eating disorders. She currently maintains a private practice for adults in Manhattan. Dr. Greif's research interests focus on the advancement and dissemination of empirically supported treatments. Dr. Greif was previously a co-investigator on two NIH clinical research trials which examined the use of a smartphone application to augment treatment for individuals with binge eating disorder and bulimia nervosa. She is currently a co-investigator on an NIH clinical trial which tests a neurobiological model of food avoidance in anorexia nervosa and examines the efficacy of a novel treatment targeting disgust among adolescents with this type of eating disorder. In 2009 Dr. Greif received the Academy for Eating Disorders Early Career Investigator Award and in 2012 she was awarded an Aaron T. Beck Scholarship for Cognitive Therapy. Dr. Greif will begin her position as an assistant professor at Stern College the Fall of 2018. She will be teaching several courses in the undergraduate psychology department including introduction to psychology, abnormal psychology, and introduction to clinical psychology.

Department of Speech-Language Pathology/Audiology

Chair: Elizabeth A. Rosenzweig MS CCC-SLP LSLS Cert. AVT
Neva Goldstein Hellman MS CCC-SLP
Susan Wilson MS CCC-SLP
Sydney Horn-Klein MS CCC-A
Jane Auriemma AuD CCC-A
Ashley Small MS CCC-SLP

The mission of the Department of Speech-Language Pathology/Audiology (SPAU) is to prepare students for admission to advanced graduate programs in the fields of Speech-Language Pathology and Audiology. Through coursework and clinical observation, students acquire knowledge of the anatomy and physiology of the speech and hearing mechanism, typical and atypical development of speech, language, hearing, and swallowing, and (re)habilitation of disorders thereof. Graduates of the SPAU Department are equipped with the foundational knowledge to become clinician-scientists who provide compassionate, evidence-based care to people with communication, hearing, and swallowing disorders and their families.

The SPAU course sequence begins with Introduction to Communication Disorders in the Spring semester of the student's sophomore year, and courses continue in a relatively fixed progression to ensure that students both acquire the foundational knowledge before moving on to advanced study and meet all of the requirements set forth by the American Speech-Language Hearing Association (ASHA) for eligibility for admission to graduate programs. Students in the SPAU department benefit from expert instruction by professors who are also practicing clinicians, allowing for the infusion of case studies and real-life examples into their coursework.

Outside of the classroom, students have many opportunities to enhance their learning. The student-let SPAU Club brings a variety of speakers to campus, helps students prepare for graduate school admission, and organizes both social and philanthropic opportunities. The students also write, edit, and publish an annual Speech and Hearing Journal. Past articles have included topics such as autism, bilingual language learning, stuttering, hearing loss, and more.

We are proud of our students' success both inside and outside of the classroom. Several of our students have been awarded Ben Gurion University summer fellowships, and have spent their summers in Israel working in speech, language, and hearing research labs. Our students have been accepted to many high-caliber graduate programs, often with academic scholarships. Our graduates have matriculated to both speech-language pathology Master's programs and clinical doctorate programs in audiology at institutions such as: Yeshiva University, Queens College, Lehman College, Touro College, Brooklyn College, Montclair University, University of San Diego/San Diego State University, Towson University, and others.

Stern College for Women Combined Programs

The following are the basic elements of combined degree programs in the sciences available to Stern College students in cooperation with other universities. Students interested in these programs generally apply to the cooperating institution during their junior year and are given a special shaped major so that they can complete all of the necessary prerequisites within the required time frame. The indicated years of study at Stern College includes the year of study abroad in Israel for those pursuing that option after high school. These programs are competitive and final admissions decisions are made by the cooperating institutions.

Engineering - B.A. /B.E. /B.S. or B.A. /M.S.

Yeshiva University offers a combined plan in engineering with Columbia University School of Engineering and Applied Science. Students interested in the Combined Program, must fulfill all the requirements for graduation, including completing a major, whether it be Pre-Engineering, Natural Sciences, or other, and must continue their studies in engineering at Columbia University.

The Pre-engineering major is open to students who can complete the major, general and **reduced** Jewish Studies requirements in 3 years - usually three years at SCW.

To be eligible to apply for admission to Columbia University through the Combined Program in Engineering, Pre-engineering majors must meet the SCW graduation requirements, other than the 128 credits, as well as all Columbia University requirements listed in the Columbia University Combined-Plan Guide (available at the Academic Advisement Center). Admission is to the two-year program at Columbia University. Columbia University will admit students based upon defined criteria, such as GPA in Columbia University-required courses, overall GPA, recommendations, *etc.* This past academic year, Columbia University admitted 2/2 SCW applicants.

If admitted to Columbia University, students should file a Maintenance of Matriculation Form at SCW. After successfully completing the two-year program at Columbia University, students file for a BA from YU, and a BS from Columbia University.

Nursing - B.A./B.S.N./M.S.N.

Stern College offers a combined program in nursing with New York University's College of Nursing (NYUCN). In this program, students complete 7 semesters of required course work with a minimum of 119 credits at Stern College (5 semesters and 84 credits in residence at Stern College for those students studying in Israel for a year). Eligible students may then be admitted to a 15-month accelerated program at NYUCN which begins in January of their senior year. Students receive a B.A. degree from Stern College for Women after successfully completing one semester at NYUCN. They are awarded the BSN from NYU at the successful completion of the nursing program and officially become a registered nurse (RN) upon passing the licensing exam. Students who maintain a 3.0 GPA while at the NYUCN are guaranteed a spot in their MSN program to become a nurse practitioner, which they may apply to after a short period of working as a RN.

Occupational Therapy - B.A./M.S.

Stern College offers a combined program in Occupational Therapy with Columbia University (CU). During the first 3 years at SCW, students complete college requirements and prerequisites for CU's OT program. They apply to the 2-year CU program during the fall semester of their junior year. Students are awarded the B.A. from Stern College after their first year at CU, and the M.S. upon completion of the program.

Optometry - B.A./O.D.

Stern College and the State University of New York (SUNY) College of Optometry offer an affiliation program to qualified students through which they can receive an undergraduate degree and a Doctor of Optometry degree in seven years. Students accepted into this program attend SCW for three years while they complete college requirements and prerequisites for the College of Optometry. After the first year at SUNY College of Optometry, students receive the B.A. degree. The O.D. degree is awarded after completing the four years at SUNY College of Optometry

Physical Therapy - B.A./DPT

Stern College offers combined program in Physical Therapy with Rutgers, the State University of New Jersey. During their first three years at Stern College (two years for those studying in Israel for a year), students complete college requirements and the prerequisites for entry into Rutgers' Doctorate of Physical Therapy Program. Students are awarded a B.A. from Stern College after completing their first year at Rutgers and the DPT upon successful completion of the 3-year doctoral program.

In addition, though an Articulation Agreement with the New York Medical College Graduate School of Health Sciences (NYMC), students may apply to NYMC's Early Acceptance Program. Qualified students receive provisional acceptance to the 3-year DPT Program after their junior year, while final acceptance is granted upon satisfactory completion of their senior year at SCW.

Physician Assistant - B.A./M.P. S.

Stern College offers a combined program in Physician Assistant Studies with Mercy College. During their first three years at Stern (two years for those studying in Israel for a year), students complete college requirements and the prerequisites for Mercy College's M.P.S. program. After completing 111 credits with a minimum overall GPA of 3.0, a minimum 3.2 GPA in the designated science courses and with at least a "B" in prerequisite courses, accepted applicants to the program continue at Mercy College during what would have been their senior year at Stern. After the first year at Mercy College, students receive a B.A. degree from Stern College. The M.P.S. degree is awarded after successfully completing two years and three months at Mercy and the student becomes a PA after passing her licensing exam.

Physician Assistant - B.A./M.S.

Stern College offers a combined program in Physician Assistant Studies with Mercy College. During their first three years at Stern (two years for those studying in Israel for a year), students complete college requirements and the prerequisites for Mercy College's M.S. program. After completing 111 credits with a minimum overall GPA of 3.0, a minimum 3.2 GPA in the designated science courses and with at least a "B" in prerequisite courses,

accepted applicants to the program continue at Mercy College during what would have been their senior year at Stern. After the first year at Mercy College, students receive a B.A. degree from Stern College. The M.S. degree is awarded after successfully completing two years and three months at Mercy and the student becomes a PA after passing her licensing exam.

Podiatry - B.A./D.P.M.

Stern College and the New York College of Podiatric Medicine offer a combined program in Podiatry. During the first three years, students recommended to the program complete college requirements and prerequisites for the NY College of Podiatric Medicine. After the first year at NYCPM, SCW awards the B.A. NYCPM awards the D.P.M. at the completion of the program.

Teaching, Math and Science - B.A./M.A.

Through an articulation agreement with the NYU Steinhardt School of Culture, Education, and Human Development, Yeshiva University juniors and seniors may enroll in selected math or science education courses at NYU. These courses will count both toward the undergraduate degree at SCW and will reduce the number of credits needed for a M.S. degree in math education or in science education from NYU Steinhardt. Students pay NYU directly for these credits.

Nutrition

Through an articulation agreement, SCW students may take selected courses in nutrition at NYU during their senior year at SCW and thus accelerate the time required to complete a subsequent graduate degree in nutrition at NYU or another school of their choice.

Student Accomplishments

Academic year, 2020-2021 and Summer 2021 Internships

Departments of Biology, Chemistry/Biochemistry, Mathematical Sciences, Computer Science, Physics, Psychology, and Speech-Language Pathology/Audiology

Allopathic medicine ("med school"): 14 students
Albert Einstein College of Medicine (5 students); Stony Brook (1); NY Med College (1) Temple Univ (1); Robert Wood Johnson (Rutgers) (1); Ben-Gurion Univ. Med Ctr (2); Sackler Med Sch (2); Technion Med Sch (1)

Osteopathic medicine: 2 students
NYIT College of Osteopathic Medicine (1); Touro College of Osteopathic Medicine (1)

Dental school: (10 students)
Columbia University (2 students); Touro College (7); NYU (1)

Optometry: (2 students)
SUNY Downstate

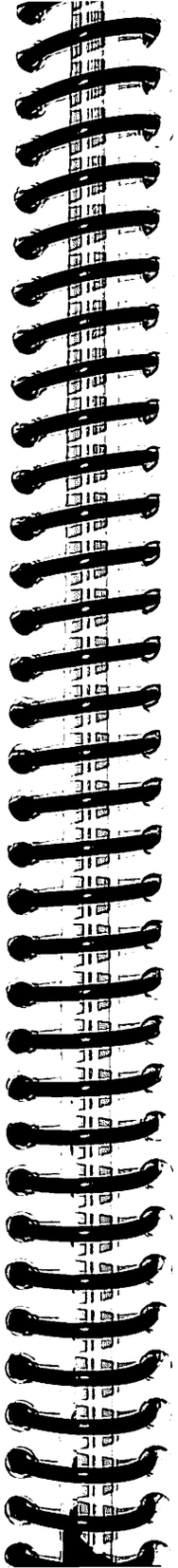
Biomed./Biol. Sci., Ph.D.: (1 student)
Weill Cornell (Pharmacology)

Nutrition & dietetics, M.S.: (2 students)
NYU

Computer science, Ph.D.: 1 student
CUNY Graduate Center

Computer science, B.S.: 2 students
Columbia University

Clinical psychology, Psy.D.: 5 students
Ferkauf Grad Sch Psychol (3); LIU (2)



Clinical psychology, Ph.D.: 1 student
Ferkauf Grad Sch Psychol

School psychology, M.S.: 1 student
Fordham Univ

Physical therapy, Doctorate: 2 students
Rutgers (1); Touro College (1)

Physician assistant, M.S.: 10 students
Katz School, YU (2); York College (3); Mercy College (3); Rutgers Univ. (1); Touro College (1)

Occupational therapy, M.S.: 7 students
Katz school, YU (2); Columbia Univ. (1); Touro (3); Nova Southeastern Univ. (1)

Genetic counseling, M.S.: 1 student
Sarah Lawrence

Speech-Language pathology, M.A./M.S.: 14 students
Katz School, YU (4); Adelphi Univ. (2); Florida Atlantic Univ. (1); Touro College (6); LIU Post (1)

Audiology, AuD (clinical doctorate): 3 students
CUNY Graduate Center (2); Montclair Univ. (1)

Public health/Public administration, M.S.; 1 student
Dual degree – public and nonprofit management & policy

Public health, M.P.H.: 1 student
Drexel University: Dornsife School of Public health

Nursing (accelerated program). 19 students
NYU (joint program) (13); NYU (2); Mount Sinai Beth Israel Phillips School of Nursing (2); Pace Univ. (2)

Summer, 2021, undergraduate research internships: 26 students
Albert Einstein Summer Undergraduate Research Program: 1 student
Bar Ilan-YU Summer Research Program: 11 students
The Rockefeller University: 1 student
YU MassChallenge-Israel Summer Internship: 1 student
YU Summer Research Program - NSF funded: Dept Physics SCW: 2 students
YC Dept of Chemistry: 4 students
SCW Dept of Biology: 5 students
NYC Health Career Opportunity Program: 2 students

Student Publications and Presentations
Scientific Journals

(Undergraduate names are in **bold** type)

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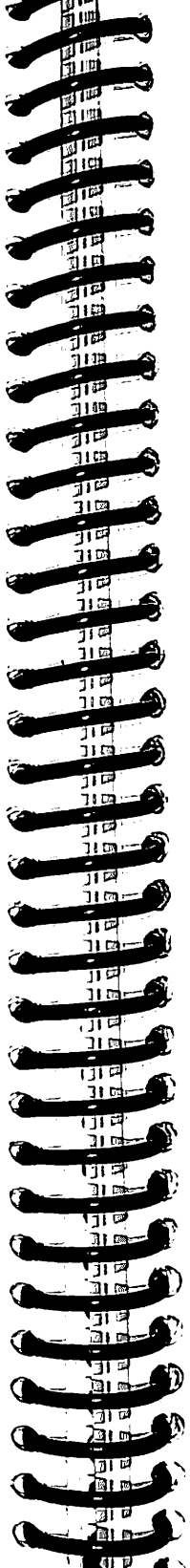

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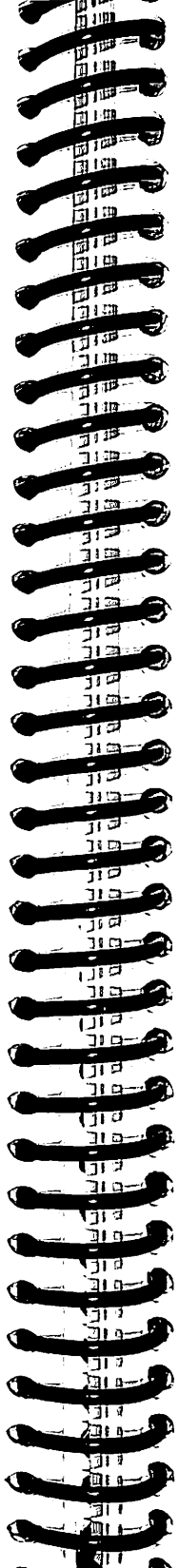

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Berman, A.Y., Alayev, A., Salamon, R.S., Berger, S.M., Schwartz, N.S, Cuesta, R., and Holz, M.K., 2016, Raptor mediated mTORC1 phosphorylation of ERα in breast cancer, 251st National Meeting of the American Chemical Society, San Diego, CA, March.

Wiener, S.L., Berman, A.Y., Alayev, A., Salamon, R.S., Sun, Y., Schwartz, N.S., Yu, J.J., and Holz, M.K., 2016, The combined effects of resveratrol and rapamycin in TSC null diseases, 251st National Meeting of the American Chemical Society, San Diego, CA, March.

Meyers, D., Martinez, K., and Chang, E.B., 2016, Understanding impaired lipid absorption in germ free mice, 251st National Meeting of the American Chemical Society, San Diego, CA, March.

Wakschlag, N. and DiLorenzo, T., 2016, The association between modest dress and body image in Orthodox Jewish Women. Poster presentation, Annual Meeting of the Society of Behavioral Medicine, Washington, D.C.

Li, Y., Korobko, R., **Lerner, A.**, Lubomirsky, I., and Frenkel, A.I., 2015, Origin of giant electrostriction in Gd doped ceria revealed by differential QEXAFS, XAFS-15 International Conference, Karlsruhe, Germany, August.

Applebaum, K., recipient of the 2015 UAN Student Travel Award to attend the American Society for Biochemistry and Molecular Biology Annual Meeting, March 28-April 1, Boston Exhibition and Convention Center, MA

Kramer, M.Y., McNabb, N.A., Guillette, L.J., Jr., and Kohno, S., 2015, The potential impacts of environmental endocrine disruptors on reproductive development, 249th National Meeting of the American Chemical Society, Denver, CO.

Gross, R.A., Wooten, A.L., Lewis, Woodard, P., and Lapi, S., 2015, Manganese-52: cyclotron production and PET/MR imaging, 249th National Meeting of the American Chemical Society, Denver, CO.

Kramer, M.Y., McNabb, N.A., Guillette, Jr., L.J., and Kohno, S., 2014, Drugged wildlife: The potential impacts of environmental endocrine disruptors on reproductive development, National Meeting of the Society for Integrative and Comparative Biology, West Palm Beach, FL, Jan. 4th

Kaufman, C., Fulop, T., Boolbol, S.K., Naam, S., Gillego, A., and Chadha, M., 2014, Are more frequent early follow up mammogram protocols necessary after breast-conserving surgery and radiation therapy, San Antonio Breast Cancer Symposium, Dec.

DiLorenzo, T., Freyberg, R, and **Siegel, A.** 2014, Sex education and adherence to sexual health recommendations in Orthodox Jewish Women. Poster presented at the Society of Behavioral Medicine Annual Meeting, Philadelphia, PA, April.

Siegel, A., DiLorenzo, T., Freyberg, R., and Donath, S., 2014, Factors associated with adherence to gynecologic screening recommendations in young Orthodox Jewish Women. Poster at the Society of Behavioral Medicine Annual Meeting, Philadelphia, PA, April.

Lerner, A., Li, Y., Frenkel, A.I., Korobko, R., and Lubomirsky, I., 2014, The origin of giant electrostriction in Gd-doped ceria as studied by modulation excitation x-ray absorption spectroscopy, Meeting of the American Physical Society, Denver, CO.

Herskowitz, J., Victor, R., and Mintzer, E., 2014, Daptomycin interactions with TOCL containing membranes, 247th American Chemical Society National Meeting, March, Dallas, TX.

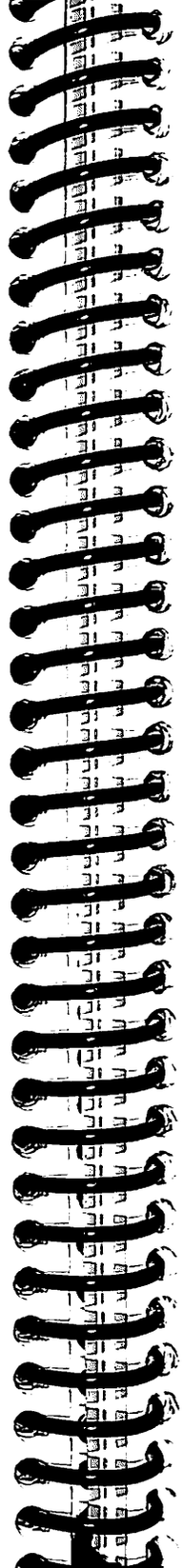
Schoor, Y. and Jordan, B.A., 2014, Prr7 is a novel regulator of the transcription factor, c-Jun, in neurons, 247th American Chemical Society National Meeting, March, Dallas, TX.

Tishbi, N. and Mintzer, E., 2014, Surface and membrane binding properties of the lipopeptide daptomycin, 247th American Chemical Society National Meeting, March, Dallas, TX.

Tishbi, N. and Rapp, C., 2014, The role of sulfation in the CCR5 chemokine receptor complex, 247th American Chemical Society National Meeting, March, Dallas, TX.

Goldsmith, A., Bryan, R., Broitman, J., and Dadchova, E., 2014, Modification of antibody 2556 recognizing HIV protein gp41 with CHXA ligand for radiolabeling and radioimmunotherapy 247th American Chemical Society National Meeting, March Dallas, TX.

Hseih, S.J., Levi, D., Prince, D., Mills, M., Dayton, C., Shah, R., **Zibak, F., Shamsian, J.**, and Gong, M.N. 2014, Staged implementation of the



ABCDE bundle improves ICU patient outcomes, Amer. Thoracic Soc., Meeting (abstract).

Hseieh, S.J., Hope, A., Dayton, C., Gershengorn, H., Shah, R., **Shamsian, J.**, Zibak, F., and Gong, M.N., 2014, The association between pre-ICU frailty and ICU delirium, Amer. Thoracic Soc., Meeting (abstract).

Weisburg, J.H., Schuck, A.G., **Greenbaum, R.E., Golfiez, M.D., Segal, J.R., Weiss, R.A., Liebman, E.C.**, Zuckerbraun, H.L., and Babich, H., 2013, Grape seed extract, a Mild prooxidant selectively cytotoxic to cancer cells. American Institute for Cancer Research Annual Meeting. Bethesda, MD.

Bonner, C., and DiLorenzo, T., 2013, A review of the literature on cognitive-behavioral therapy for anxiety and depression in school settings. Ferkauf Graduate School of Psychology, Behavioral Sciences Student Research Conference.

Donath, S., and DiLorenzo, T., 2013, Remediating academic impacts of early neglect. Ferkauf Graduate School of Psychology, Behavioral Sciences Student Research Conference.

Farzan, Y., and Freyberg, R., 2013, Effects of affect on prosocial behavior: A review of the literature. Ferkauf Graduate School of Psychology, Behavioral Sciences Student Research Conference.

Frenkiel, L., and DiLorenzo, T., 2013, Spiritual and religious coping in cancer patients. Ferkauf Graduate School of Psychology, Behavioral Sciences Student Research Conference.

Kazlow, C., and DiLorenzo, T., 2013, The effects of terrorism on children: The implications of type of trauma, level of exposure, and individual vulnerability. Ferkauf Graduate School of Psychology, Behavioral Sciences Student Research Conference.

Last, T., and Freyberg, R., 2013, Cyberbulling: Predictive factors and harmful effects. Ferkauf Graduate School of Psychology, Behavioral Sciences Student Research Conference.

Pasternak, E., and Bacon, J., 2013, A modified sound localization task as a sensitive test of processing speed in multiple sclerosis patients. Ferkauf Graduate School of Psychology, Behavioral Sciences Student Research Conference.

Siegel, A., and DiLorenzo, T., 2013, Are knowledge, family and friend history of disease and perceived risk predictive of the uptake of gynecologic health recommendations in orthodox Jewish women? Ferkauf Graduate School of Psychology, Behavioral Sciences Student Research Conference.

Yarmush, D., and Freyberg, R., 2013, The effect of music on cognitive, verbal, and task performance. Ferkauf Graduate School of Psychology, Behavioral Sciences Student Research Conference.

Schuck, A.G., **Wargon, S.E., Tauber, L., Miller, S.H., Weinstock, H.R.**, Weisburg, J.H., Zuckerbraun. H.L., and Babich, H. 2013. Ellagic and gallic acids, dietary polyphenols with selective cytotoxicity to oral carcinoma HSC-2 cells. Society for In Vitro Biology Annual Meeting, Providence, RI

Tishbi, N. and Mintzer, E., 2013, Surface and membrane binding properties of the lipopeptide daptomycin, 57th Annual Meeting of the Biophysical Society, Philadelphia, PA.

Joel, K., Kollmar, D., and Santos, L. F 2013, Spectrum, symmetries, and dynamics of Heisenberg spin-1/2 chains (oral presentation), International Meeting of the American Physical Society, March Meeting, Baltimore, MD.

Kollmar, D. and Santos, L. F 2013, Invariant correlation entropy as a signature of quantum phase transitions in spin-1/2 systems (oral presentation), International Meeting of the American Physical Society, March Meeting, Baltimore, MD.

Laufer, T.S. and Rapp, C. 2013, Effects of tyrosine o-sulfation on binding affinity in CXCR4-SDF-1 complexes, 245th National Meeting of the American Chemical Society, New Orleans, LA.

Snow, S. and Rapp, C., 2013, Role of tyrosine o-sulfation in the CX-CR4-SDF-1 chemokine receptor complex, 245th National Meeting of the American Chemical Society, New Orleans, LA.

Robin, E.F., Wietschner, J.K., Zuckerbraun, H.L., Babich, H., Schuck, A.G., and Weisburg, H.J., 2013, Gallic acid, an inducer of apoptosis to human oral carcinoma HSC-2 cells as mediated through oxidative stress, 245th National Meeting of the American Chemical Society, New Orleans, LA.

Schoor, Y. and Velisek, 2013, Different route of administration for melanocortin receptor agonist, melanotan II, in the model of cryptogenic infantile spasms, 245th National Meeting of the American Chemical Society, New Orleans, LA.

Weinstein, A., Baker, M.E.R., Hughes, C.M., Allis, D., McEwen, B.S., and Hunter, R.G., 2013, Evidence for the role of a novel histone mark in hippocampal neurogenesis, 245th National Meeting of the American Chemical Society, New Orleans, LA.

Sedletcaia, A., **Unger, H.A.**, Maruani, D.M., and Holz, M.K., 2012, New targets of mTORC1 pathway in ER-positive cells, American Association for Cancer Research Annual Meeting, Chicago, IL.

Chitgarha, M.T, Khaleghi, S., Daab, W., Ziyadi, M., Mohajerin-Ariaei, A., **Rogawski, D.**, Tur, M., Vusirikala, V., Zhao, W., Touch, J., and Willner, A.E. 2012. Demonstration of WDM OSNR Performance Monitoring and Operating Guidelines for Pol-Muxed 200-Gbit/s 16-QAM and 100-Gbit/s QPSK Data Channels. Optical Fiber Communication Conference and Exposition (OFC).

Amram, R., and DiLorenzo, T., 2012, Prevalence and pedictors of academic dishonesty. Poster to be presented at the Annual Meeting of the American Psychological Association, Orlando, Fl.

Freyberg, R., and **Bart, M.**, 2012, Olfactory environment influences close relationships through multiple methods of measurement. Poster presented at the Annual Conference of the Association of Chemoreception

Sciences, Huntington Beach, CA.

Gofine, M., and Dilorenzo, T., 2012, How are we doing? A review of assessments within writing centers. Ferkauf Graduate School of Psychology, Behavioral Sciences Student Research Conference.

Michalowksi, A., and Freyberg, R., 2012, The effect of directed writing on depression and anxiety. Ferkauf Graduate School of Psychology, Behavioral Sciences Student Research Conference.

Pasternak, E., and Bacon, J., 2012, Demystifying insight: A review. Ferkauf Graduate School of Psychology, Behavioral Sciences Student Research Conference.

Zughaft, M., Taylor, D.J., and Harburger, L.L., 2012, Effects of endogenous and exogenous sex hormones on object memory and spatial ability in young and aged women. 16th Annual N.E.U.R.O.N. Conference Program.

Zughaft, M., Taylor, D., and Harburger, L., 2012, Effects of endogenous and exogenous sex hormones on object memory and spatial ability in young and aged women. Ferkauf Graduate School of Psychology, Behavioral Sciences Student Research Conference.

Gharagozloo, P., Arcasedda, F., Khatamee, M., Gutierrez-Adan, A., Drevet J., Krey, L., **Mandelbaum, M.**, Smith, M., Kramer, Y., Sanchez, X., Lu, L., McCaffrey, C., and Grifo, J., 2012, Age, sperm, & oocyte stress and infertility, American College of Obstetricians and Gynecologists, May 8th, San Diego, CA.

Vigodner, M., Nieves,E., Shrivastava, V., Callaway, M.B., **Marmor, H.**, and **Chernyak, S.-B.**, 2012, Identification of sumoylated proteins in human sperm, American Society of Andrology (ASA) 37th Annual Conference, April 21 – 24, Tucson, Arizona.

Hachen, M., Hunter, R.G., Pfaff, D.W., and McEwen, B.S., 2012, Stress modulates mitochondrial gene expression in the rat hippocampus, 243rd American Chemical Society Meeting, San Diego, California, Spring semester.

Gubin A. and Santos L.F., Quantum Chaos: An introduction via chains of interacting spins 1/2, Oral presentation, March Meeting 2011, American Physical Society, Boston, MA.

Karp, E., Novikov, L., **Klerman, H.**, and Gamble, M.J., 2012, Understanding the role of intronic cis-acting elements in the splicing of macroH2A1 variants, 243rd American Chemical Society meeting, San Diego, California, Spring semester.

Wolf, B.J., Reiss, S.E., Babich, H., Weisburg, J.H., Schuck, A., and Zuckerbraun, H., and **Fertel, S.** 2012, Proapoptotic effects of ellagic acid, a metabolite of pomegranate extract, on human oral carcinoma HSC-2 cells, 243rd American Chemical Society meeting, San Diego, California, Spring semester, 2012.

Hachen, M., Hunter, R.G., Pfaff, D.W. and McEwen, B.S., 2011, Stress modulates mitochondrial gene expression in the rat hippocampus, Society for Neuroscience Abstracts, Washington, D.C.

Shrivastava, V., **Marmor, H., Gutstein, L.**, Chernyak, S.-B., and Vigodner, M., 2011, SUMO proteins may regulate multiple functions in human sperm which can besignificantly affected by cigarette smoke, FAMRI Web Symposium.

Bart, M., and Freyberg, R., 2011, Fragrance change impacted interactions of close female friends. Chemical Senses, 36, A100-101.

Bacon, J., Kalina, J., Bochkanova, A., **Ausubel-Strauchler, Y.** and Herbert, J., (2011). Cognitive rehabilitation benefits multiple sclerosis patients only if they are active participants in the program. Neurology, 76 (S4): A85.

Harburger, L.L. and **Taylor, D.J.**, (2010). The effects of age on object memory and spatial ability in women. Society for Neuroscience Abstracts, Program # 605.2.

Huisman, T., Chatterjee, S., Volpi, S., and Birshtein, B., 2011, AID and

Gadd45a: Involved in active DNA demethylation of the 3'RR and in class switch recombination? 241st American Chemical Society National Meeting, Anaheim, CA, March.

Rogawski, R. and Mintzer, E., 2011, Elucidating the interaction of LPA with model membranes, 241st American Chemical Society National Meeting, Anaheim, CA, March.

Rosenblatt, K., Avogadri, F., Li, Y., Murphy,J., Merghoub, T., Houghton, A., and Wolchok, J., 2011, Detection of TRP-2 antibodies in the serum of TRP-2 immunized mice, 241st American Chemical Society National Meeting, Anaheim, CA, March.

Schuck, A.G., **Cohen, S.S., Lerman, L.T., Haken, O.**, and Weisburg, J.H., 2011, Pomegranate and olive fruit extracts, prooxidants with antiproliferative and proapoptotic activities towards HSC-2 carcinoma cells. Society for In Vitro Biology Annual Meeting, Raleigh, NC, June.

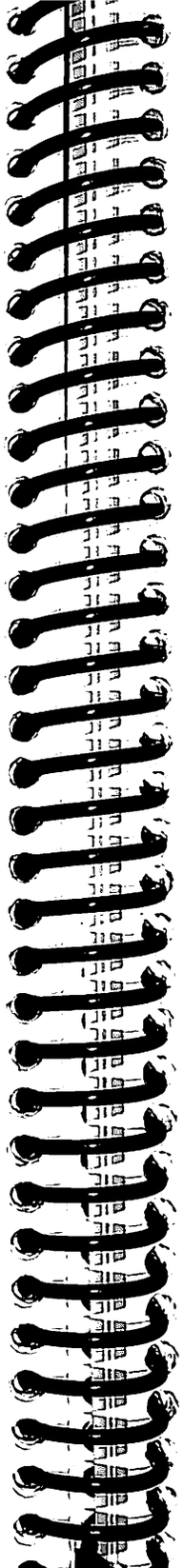
Hasten, E., Lazaros, J., and Schuck, A.G., 2011, Pro-oxidant and pro-apoptotic activities of olive fruit extract toward oral carcinoma cells. Columbia University Undergraduate Research Symposium, April.

Hirth, Y.A., Zuckerbraun, H.L., and Weisburg, J.H., 2011, Decrease in intracellular glutathione and induction of apoptosis in HSC-2 carcinoma cells from the human oral cavity due to pomegranate juice extract. Society for In Vitro Biology Annual Meeting, Raleigh, NC, June.

Schneider, J., Gutstein, L., Shrivastava, V., and Vigodner, M., 2011, SUMO proteins may regulate head reshaping, capacitation, and stress response in human sperm, Columbia University Undergraduate Research Symposium, Spring, April.

Hirth, Y.A., Zuckerbraun, H.L., and Weisburg, J.H., 2011, Decrease in intracellular glutathione and induction apoptosis in HSC-2 carcinoma cells from the human oral cavity due to pomegranate juice extract. Society for In Vitro Biology Annual Meeting, Raleigh, NC, June

Schneider, J., Gutstein, L.E., Shrivastava, V., and Vigodner, M. 2011,



SUMO proteins may regulate head reshaping, capacitation, and stress response in human sperm, XXIst North American Testis Workshop, Montreal, Quebec, Canada, 3/30-4/2.

Maruani, M., **Harris, E., Shachter, A.**, and Holz, M.K., 2011, Co-regulatory relationship between estrogen receptor alpha and the mTOR/S6K1 signaling pathways, American Association for Cancer Research 102nd Annual meeting, Orlando, FL, April.

Schneider, J., Gutstein, L., Shrivastava, V., and Vigodner, M., 2011, SUMO proteins May regulate head reshaping, capacitation, and stress response in human sperm, Columbia University Undergraduate Research Symposium, Spring.

Gross, J., Ennis, R.D., Homel, P., Evans, A., Gliedman, P., Choi, W., Hu, K., Shasha, D., Harrison, L.B., and S. Fleishman, 2010, The rapid increase in radiation oncology consultation and treatment of the extreme elderly and its independence from population growth, America Society for Radiation Oncology (ASTRO) Annual Meeting.

Marinkovic, N., Wang, Q., Barrio, **Cooper, C.**, and Frenkel, A.I., 2010, Synchronous XAFS/DRIFTS Study of CO adsorption on Al2O3-supported Pt clusters. The First North American Core Shell Spectroscopy Conference, Denver, CO.

Donington, J.S., Blasberg, J.D., Goparaju, C.M.V., **Hirsch, N.**, and Pass, H.I., 2010, Molecular heterogeneity of osteopontin Isoforms in non-small cell lung cancer, American Association of Cancer Research, International Association for the Study of Lung Cancer Joint Conference on Molecular Origins of Lung Cancer, Coronado, CA.

Goparaju, C., Donington, J., **Hirsch, N.**, Harrington, R., and Pass, H.I., 2010, EphB2 expression parallels malignant behavior in mesothelioma, American Association of Cancer Research, 101st Annual Meeting, Washington, D.C.

Donington, J.S., Goparaju, C.M.V., Blasberg, J.D., **Hirsch, N.**, Harrington, R,, Pass, H.I., and Neubert, T., 2010, Extracellular mediation of divergent

impact of OPN splice variants in non-small cell lung cancer, Osteopontin Biology, FASEB Summer Research Conference, Steamboat Springs, CO.

Donington,. J.S., Blasberg, J.D., Goparaju, C.M.V., **Hirsch, N.**, Harrington. R., and Pass, H.I., 2010, Argatroban inhibition of osteopontin modulates isoform specific malignant properties in non-small cell lung cancer. 10th Targeted Therapy meeting, Santa Monica, CA (presented but not published).

Gross, J., Ennis, R.D., Homel, P., Evans, A., Gliedman, P., Choi, W., Hu, K., Shasha, D., Harrison, L.B., and S. Fleishman, 2010, The rapid increase in radiation oncology consultation and treatment of the extreme elderly and its independence from population growth, America Society for Radiation Oncology (ASTRO) Annual Meeting.

Horowitz, D. and Dilorenzo, T., 2010, The efficacy of hypnosis in pediatric cancer care, Ferkauf Graduate School of Psychology, Behavioral Sciences Student Research Conference.

Stiefel, E. and Freyberg, R., 2010, Trying to remember: A literature review about improving eye-witness testimony, Ferkauf Graduate School of Psychology, Behavioral Sciences Student Research Conference.

Rollhaus, E. and Freyberg, R., 2010, An analysis of the effects of altering directives in narrative therapy, Ferkauf Graduate School of Psychology, Behavioral Sciences Student Research Conference.

Scholl, C. and Dilorenzo, T., 2010, The issue of "faking good" on self report personality measures in personnel selection, Ferkauf Graduate School of Psychology, Behavioral Sciences Student Research Conference.

Zitter, S., Bryk, D., Fox, A., Narlieva, M., Pan, Q., Chang, T., Cloherty, G., and Lucic, D., 2010, Swine influenza or seasonal influenza? The first clinical adaptation of an automated open platform for swine influenza. The Montefiore experience, Young Research Investigators Symposium at Montefiore Medical Center, Bronx, NY, **third place winner.**

Shrivastava,V., **Miller, R.**, **Lazaros, S.H.**, and Vigodner, M., 2010, Su-

moylation as a sensitive marker of a tobacco-induced oxidative stress in the testis, FAMRI meeting, Miami, Florida (May)

Deluty, J., Seto, J., and Sealfon, S., 2010, Elucidating the signaling pathways of the immune response in monocytes, Columbia University Undergraduate Research Symposium, Spring.

Dinerman, J. and Santos, L.F., 2010, Controlling the Evolution of a Quantum System with Dynamical Decoupling Methods, Oral presentation, March Meeting, American Physical Society, Portland, OR.

Holz, M.K., **Seligman F.F.**, **Spiegel T.N.**, and **Maruani D.M.**, 2010, Estrogenic regulation of S6 kinase 1 expression creates a positive feed-forward loop in control of breast cancer cell proliferation, AACR 101st Annual Meeting, Washington, DC.

Huisman, T. and Hodgson, L., 2010, Spectral modification to genetically encoded single-chain RhoA biosensor, 239th National Meeting, American Chemical Society, San Francisco, CA

Liebling, E.J., Asenjo, A.B., De Paoli, V.M., Rath, U., Sharp, D. J., and Sosa, H., 2010, Interactions between microtubules and kinesin-1,3, 239th National Meeting, American Chemical Society, San Francisco, CA.

Mintzer, E., and **Rogawski, R.**, 2010, Elucidating the interaction of LPA with model membranes, Columbia University Undergraduate Research Symposium, Spring.

Solodokin, L.J., **Canter, A.**, **Freilich, A.**, **Haken, O.**, **Ovits-Levy, C.G.**, Schuck, A.S., and Babich, H., 2010, Anticarcinogenic and prooxidant properties of pomegranate juice extract and olive fruit extract, Columbia University Undergraduate Research Symposium, Spring.

Weiss, R.S., Zhang, C., and Cuervo, A.M., 2010, Identification of markers for autophagy in serum, 239th National Meeting, American Chemical Society, San Francisco, CA.

Yamnik, R.L. and Holz, M.K., 2009, mTOR/S6K1 and MAPK/RSK sig-

naling pathways coordinately regulate estrogen receptor alpha serine 167 phosphorylation, Cancer Res., 69:A31S

Holz. M.K., **Digilova, A., Yamnik, R., Davis, D.**, Murphy. C., and N. Brodt, 2009, Estrogen receptor alpha is a target of mTOR/S6K1 signaling in control of breast cancer cell proliferation, Cancer Res. 69:269S (abstract).

Bellman, A. and DiLorenzo, T, 2009, The association between feminism, religiosity, and psychological well-being in Jewish women, Yeshiva University Behavioral Sciences Student Research Conference.

Ganz, D., and DiLorenzo, T, 2009, Comorbid suicidality and alcohol abuse in adolescents: Etiologic factors, Yeshiva University Behavioral Sciences Student Research Conference.

Hanau, T. and DiLorenzo, T, 2009, Etiology and treatment of bulimia nervosa, Yeshiva University Behavioral Sciences Student Research Conference.

Hazan, R. and DiLorenzo, T, 2009, Prolonged/imaginal exposure in PTSD: A literature review, Yeshiva University Behavioral Sciences Student Research Conference.

Hazan, R. and R. Freyberg, 2009, Victim of the act or the offender? Exploring the emotional and psychological responses of sexual assault and rape victims based upon the victim-offender relationship, Yeshiva University Behavioral Sciences Student Research Conference.

Miller, R. and Harburger, L, 2009, Does Ben Franklin Effect increase with effort? Yeshiva University Behavioral Sciences Student Research Conference.

Reichman, D. and DiLorenzo, T, 2009, Influence of family support on PTSD in children, Yeshiva University Behavioral Sciences Student Research Conference.

Rollhaus, E., and R. Freyberg, 2009, Directives in Narrative Therapy,

Yeshiva University Behavioral Sciences Student Research Conference.

Sonenberg, R. and DiLorenzo, T, 2009, A review of the literature on the psychological effects of 9/11 in children, Yeshiva University Behavioral Sciences Student Research Conference.

Spiegel, T. and DiLorenzo, T, 2009, Does MRI screening have a negative psychological effect on women who carry the BRCA gene? Yeshiva University Behavioral Sciences Student Research Conference.

Stiefel, E. and R. Freyberg, 2009, The multi-faceted Jew: A study on the integration of the interdependent self and the independent self in Jews in America, Yeshiva University Behavioral Sciences Student Research Conference.

Dinerman, C., Keller, and B. Herold, 2009, Genital secretions confer anti-E. coli activity, Montifiore Pediatric Research Day, 1St prize for a student poster.

Dukesz, F., Zilbergerts, M., and L. F. Santos, 2009, Interplay between interaction and (un)correlated disorder in Heisenberg spin 1/2 chains, March Meeting of the American Physical Society, Pittsburgh.

Ackerman, N.J., Burekhovich, F., Schuck, A.G., Zuckerbraun, H.L., and H. Babich, 2009, Gingko biloba leaf extract induces oxidative stress in HSC-2 carcinoma cells, Columbia University Symposium of Undergraduate Research, Spring. (abstract and oral presentation).

Ruderman, E., Zack, E., and A.G. Schuck, 2009, Antitumorigenic and prooxidant activities of blueberry extract to human oral cancer cells, Columbia University Undergraduate Research Symposium, Spring. (abstract).

Bromberg, M.R., Patolla, A., Wang, O., Segal, R., Han W.-Q., Feldman, I., Zypman, F.R., Iqhal, Z., and A.I. Frenkel, 2009 , Platinum nanoparticles on SWNT nanopaper support: Synthesis, characterization, and application in electrocatalysis, The 237th American Chemical Society Meeting, Salt Lake City, Utah, March (abstract)

Charles, G., and E.A. Mintzer, 2009, Comparison of the behavior of native cholesterol and two oxidized cholesterol derivatives, The 237th American Chemical Society Meeting, Salt Lake City, Utah, March (abstract)

Charles, G. and E.A. Mintzer, 2009, Oxysterols alter the propensity of lipid raft formation in model membranes, Columbia University Undergraduate Research Symposium, Spring. (abstract).

Herzberg, B.M., Ting, L.-M., Mwakingwe, A., Croken, M.M., Madrid, D., Hochman, S., and K. Kim, 2009, Genetic studies of adenosine deaminase in the rodent malaria parasites, **Plasmodium yoelii** and *Plasmodium berghei*, The 237th American Chemical Society Meeting, Salt Lake City, Utah, March (abstract)

LeVee, A.J., and E.V. Prodan, 2009, Molecular electronics: Tunneling devices with semiconducting leads, The 237th American Chemical Society Meeting, Salt Lake City, Utah, March (abstract)

Liebling, E., Burger, R.F., Zuckerbraun, H.L., Schuck, A.G., and H. Babich, 2009, Protective effects of pyruvate through mediation of oxidative stress, Columbia University Symposium of Undergraduate Research, Spring (abstract).

Merzel, M., Grace, M., and M. Balwani, 2009, Development and validation of a dried blood spot assay for chitotriosidase, an important biomarker for Gaucher Disease, The 237th American Chemical Society Meeting, Salt Lake City, Utah, March (abstract)

Pekar, M., Grosser, E., Goodfriend, G., Im, J. and M.Vigodner, 2009, Stress-induced response and apoptosis in germ and somatic testicular cells: involvement of SUMO proteins, Columbia University Symposium of Undergraduate Research, Spring (abstract).

Schiffmiller, A., Rapp, C., Kalyanaraman, C., and M. Jacobson, 2009, Theoretical ranking of a congeneric series of protein kinase inhibitors, Columbia University Symposium of Undergraduate Research, Spring. (abstract)

Holz, M.K., **Digilova, A., Yamnik, R., Davis, D.**, Murphy, C., and **N. Brodt**, 2008, The role of S6 kinase 1 in breast cancer, San Antonio Breast Cancer Symposium.

Atlas, A., McCarthy, J.W., and M. Feldmesser, 2008, *Aspergillus fumigatus* proteins bound by a germination-inhibitory monoclonal antibody, National Meeting of the American Chemical Society, New Orleans, LA.

Bellman, A. and T. DiLorenzo, 2008, Gender Identity Disorder: A review of the literature. Ferkauf Graduate School of Psychology Behavioral Sciences Student Research Conference.

Blau, L., Estes, D., **Seleski, N.** and **S.A.Guigui**, 2008, Stabilizing of deoxyoligonucleotide duplexes by base stacking, National Meeting of the American Chemical Society, New Orleans, LA.

Clark, E., Seideman, J., Silverman, J., Gardner, J., Scheinberg, D.A., and J.H.Weisburg, 2008, P-Glycoprotein independent resistance to oxidative stress in leukemia cells, National Meeting of the American Chemical Society, New Orleans, LA.

Dukesz, F., Frenkel, A.I., Bromberg, M.R.,Wang, O., Asherie, N., Blass, S., Rafailovich, M.H., Sun, Y., and J. Kang, 2008, Comparing various methods of synthesis and analysis of gold nanoparticles, National Meeting of the American Chemical Society, New Orleans, LA.

Fathy, J., Seleski, N., Dinerman, E., and M.Vigodner, 2008, Expression of SUMO protein in normal testicular cells and germ cell tumors, Columbia University Spring Undergraduate Research Symposium.

Feldman, A., Benichou, C., Skop, N., and M.Vigodner, 2008, Heat-induced stress response in germ and somatic testicular cells: involvement of SUMO proteins, Columbia University Spring Undergraduate Research Symposium.

Freyberg, R., and **M. Bensoussan**, 2008, The impact of fragrance on social relationships. Poster presented at the 2008 Biannual Conference on Human Development, Indianapolis, IN.

Freyberg, R., **Bensoussan, M.**, and **A. Silver**, 2008, Disruption of olfactory environment impacts close relationships in young women. National Meeting of the International Symposium of Olfaction and Taste, San Francisco, CA.

Greer, D. and R. Freyberg, 2008, Personality type as a predictor of religious identity and conflicts, Yeshiva University Behavioral Sciences Student Research Conference.

Guigui, S.A., House, R., Dulyaninova, N. and A. Bresnick, 2008, Characterization of a scfv to non-muscle myosin-II, National Meeting of the American Chemical Society, New Orleans, LA.

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erences in young women.Yeshiva University Behavioral Sciences Student Research Conference.

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Ackerman, R., Weiss, T., and T. DiLorenzo, 2006, CBT: Modification of dating habits: A case study, Yeshiva University Behavioral Sciences Student Research Conference.

Dickstein, D. and T. DiLorenzo, 2006, Relationship status as a predictor of caregiver burden in traumatic brain injury, Yeshiva University Behavioral Sciences Student Research Conference.

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Harris, T., Soussan, L., Isseroff, R., Sun, Y., Rafailovich, M.H., and A.I. Frenkel, 2006, EXAFS studies of palladium nanoparticles: Size control and hydrogenation, XAFS13 Conference, Stanford, CA.

Pease, D.M., Frenkel, A.I., Shanthakumar, P., Huang, T., Balasubramanian, M., Budnick, J.I., Brewe, D., **Abitbol, N.**, and O. Odom, 2006, Performance and improved design of the log spiral of revolution monochromator, XAFS13 Conference, Stanford, CA.

Frenkel, A.I., Pease, D.M., Budnick, J., Shanthakumar, P., Huang, T., **Abitbol, N.**, and P. Metcalf, 2006, X-Ray Absorption Fine Structure study of the metal-insulator transition in Cr doped V2O3, March Meeting of the American Physical Society, Baltimore, MD.

Sun, Y., Frenkel, A.I., Isseroff, R., **Shonbrun, C.**, Forman, M., Shin, K., Koga, T., White, H., Rafailovich, M., and J. Sokolov, 2006, Characterization of Palladium and Gold nanoparticles using x-ray reflectivity, EXAFS and electron microscopy, March Meeting of the American Physical Society, Baltimore, MD.

Zaghi, D., Jacobson. M., and G. Barreiro, 2006, pH Sensitivity in talin, 232nd National Meeting of the American Chemical Society, San Francisco, CA.

Feig, J.L., Ha, S., Rudoff, R., and S.K. Logan, 2006, ART-27: a novel co-activator with tumor suppressor function in the prostate, 231st National Meeting of the American Chemical Society, Atlanta, GA.

Fridman, F., Erika, A., Ringia, T., and V.L. Schramm, 2006, Inhibitor screening for human nucleoside phosphorylase, bovine xanthine oxidase, and E. coli thymidine phosphorylase, 231st National Meeting of the American Chemical Society, Atlanta, GA.

Goldberg, M.S., Gerke, J.P., and Cohen, B.A., 2006, Correlation of gene expression and sporulation efficiency in *Saccharomyces cerevisiae*, 231st National Meeting of the American Chemical Society, Atlanta, GA.

Levine, E., Mandell, D., Jacobson, M.P., and C.S. Rapp, 2006, An implicit solvent study of phosphorylation in protein molecules, 231st National Meeting of the American Chemical Society, Atlanta, GA.

Soussan, L.L., Harris, T., Isseroff, R., Sun, Y., Rafailovich, M., and A.I. Frenkel, 2006, Thiol-stabolized palladium nanoparticles: size control and hydrogenation, 231st National Meeting of the American Chemical Society, Atlanta, GA.

Estes, D.W, **Ben-Zvi, N.**, and L. Blau, 2006, The DNA melt, 19th Biennial Conference on Chemical Education, West Lafayette, IN, July.

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Galian, L. and T. DiLorenzo, 2005, Pain and gender: The underlying difference, Yeshiva University Behavioral Sciences Student Research Conference.

Sweet, R. and T. DiLorenzo, 2005, Sociotropic cognitions and levels of

spirituality, Yeshiva University Behavioral Sciences Student Research Conference.

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Frenkel, A.I.,Pease, D.M., Shanthakumar, P., Huang, T., **Abitbol, N.**, **Soussan, L.**, and J. I. Budnick, 2005, X-ray absorption fine structure study of the metal-insulator transition in Cr doped V2O3, Fall Meeting of the Materials Research Society, Boston, MA.

Sun, Y., Isseroff, R., **Shonbrun, C.**, Forman, M., Frenkel, A.I., Shin, K., Koga, T., White, H., Rafailovich, M.H., and J.C. Sokolov , 2005, Characterization of palladium nanoparticles using x-ray reflectivity, EXAFS and electron microscopy, Fall Meeting of the Materials Research Society, Boston, MA.

Nissim, H.A., **Krupka, M.E.**, Zuckerbraun, H.L., and H. Babich, 2005, Differential *in vitro* cytotoxicity of (-)-epicatechin gallate to cancer and normal cells from the human oral cavity, 229th National Meeting of the American Chemical Society, San Diego, CA.

Roth, R., Ozelius, L., and L. Liu, 2005, Explanation of alternative splicing in SGCE gene, 229th National Meeting of the American Chemical Society, San Diego, CA.

Nemzer, S., **Harris, T.**, **Pister, I.**, **Soussan, L.**, Sun, Y., Rafailovich, M., and A. Frenkel, 2005, Characterizing nanoparticle size using EXAFS and TEM, 229th National Meeting of the American Chemical Society, San Diego, CA.

Nemzer, S., **Harris, T.**, **Pister, I.**, **Soussan, L.**, Sun, Y., Rafailovich, M., and A.I. Frenkel, 2005, Size control of thiol-stabilized gold nanoparticles: combined EXAFS and TEM characterization, 229th National Meeting of the American Chemical Society, San Diego, CA.

Pister, I., **Soussan, L.**, **Nemzer, S.**, **Harris, T.**, Frenkel, A.I., Sun, Y., and

M.H. Rafailovich, 2005, Size dependent changes of the local structure in dodecanethiol-stabilized gold nanoparticles, Annual Meeting of the American Physical Society, Los Angeles, March (oral presentation).

Goldmintz, Y., and T. DiLorenzo, 2004, Efficacy of selective serotonin reuptake inhibitors vs. tricyclic antidepressants in elderly melancholic depressed, Yeshiva University Behavioral Sciences Student Research Conference.

Wiesen, T., and T. DiLorenzo, 2004, Somatization in Dominican individuals, Yeshiva University Behavioral Sciences Student Research Conference.

Wright, N. and T. DiLorenzo, 2004, Social influence on women and heart disease: Perceived risk and preventive health behaviors, Yeshiva University Behavioral Sciences Student Research Conference.

Ben-Zvi, N., Juszczak, L. and J. Friedman, 2004, Unfolding and refolding of the mini-protein TC5b in a confined, cell-like environment, 227th National Meeting of the American Chemical Society, Anaheim, CA.

Douglas, E., Ravetch, J.V. and B. Diamond, 2004, Fcy receptor expression on peripheral blood mononuclear cells in SLE, 227th National Meeting of the American Chemical Society, Anaheim, CA.

Glasner, D., Frenkel, A.I, and F.R. Zypman, 2004, Geometrical properties of metal nanoparticles, 227th National Meeting of the American Chemical Society, Anaheim, CA.

Suttner, S., Sukhu, B., and H.C. Tenenbaum, 2004, Effect of the inflammatory cytokine (IL)-1b on osteoclast formation and function in human umbilical cord blood cells, 228th National Meeting of the American Chemical Society, Philadelphia, PA.

Reinman, I., Benmergui, D., and C.S. Rapp, 2004, Theoretical investigation of ligand stabilization in fatty acid binding proteins, 228th National Meeting of the American Chemical Society, Philadelphia, PA.

Glasner, D., Zypman, F., and A.I. Frenkel, 2004, Geometric properties of metal nanoparticles, Annual NSLS Users Meeting, Brookhaven National Laboratory, May.

Frenkel, A.I., **Glasner, D.**, Zypman, F., Nuzzo, R., and L. Menard, 2004, 3D-structure of thiol-capped gold nanoparticles, Annual Meeting of the American Physical Society, Montreal, Canada.

Reingold, S.O., Gu, J., Fernandez, R. and R.L. Katz, 2003, Interphase fluorescence *in situ* hybridization (FISH) to demonstrate translocation of cyclin D1 (CCD1) gene to chromosome 14 immunoglobulin heavy chain locus (IGH) with resultant overexpression of cyclin D1 protein in a mantle cell lymphoma cell line, 225th National Meeting of the American Chemical Society, New Orleans, LA.

Sedletcaia, A. and P. Cohen, 2003, Localization of PMS2 in meiotic cells, 225th National Meeting of the American Chemical Society, New Orleans, LA.

Josovitz, J., Verdier-Pinanrd, P. and S. B. Horwitz, 2003, Analysis of stathmin and MAP- 4 content in taxol resistant cell lines, 225th National Meeting of the American Chemical Society, New Orleans, LA.

Gamss, C.A., Ting, L.-M., and K. Kim, 2003, Inhibition of the purine salvage pathway in *Plasmodium falciparum*, 226th National Meeting of the American Chemical Society, NY, NY.

Frankel, R., **Fischer, T.** and C.S. Rapp, 2003, The effects of crystal packing on protein loop structures, 36th Middle Atlantic Regional Meeting of the American Chemical Society, Princeton, NJ

Frenkel,A.I., **Frankel, S.C.**, and T. Liu, 2003, Structural stability of gian polyoxomolybdate molecules as probed by EXAFS. XAFS XII Conference, Malmo, Sweden.

DiLorenzo, T, Erblich, J, Montgomery, G, **Ephron, R.**, **Shaffren, M.** and Bovbjerg, D, 2002, Family histories of disease and disease-specific worry: The role of perceived risk. National Meeting of the Society of Behavioral Medicine Annual Meeting, Washington, D.C.

Frankel, S.C., and A. Frenkel, 2002, Reduction of nickel oxide with hydrogen from local perspective, 223rd National Meeting of the American Chemical Society, Orlando, FL.

Kenigsberg, B., Kaufman, H. and R. Glover, 2002, Immune responses to recombinant BCG expressing carcinoembryonic antigen, 223rd National Meeting of the American Chemical Society, Orlando, FL.

Kenigsberg, B., **Sedletcaia, A.**, Estes, D. and L. Blau, 2002, Twenty years of bonding; the Chemistry club and the ACS, 223rd National Meeting of the American Chemical Society, Orlando, FL.

Nivasch, R., Chill, J. and J. Anglister, 2002, NMR-based homology model of the interferon a receptor, 2002, 223rd National Meeting of the American Chemical Society, Orlando, FL.

Sedletcaia, A., Kenigsberg, B. and H. Babich, 2002, *In vitro* cytotoxicity of protocatechuic acid, an inducer of oxidative stress, 223rd National Meeting of the American Chemical Society, Orlando, FL.

Sedletcaia, E., Matthiesen, S.H. and B.H. Sator, 2002, Parafusion homologue in *Tetyrahymena thermophila*, 223rd National Meeting of the American Chemical Society, Orlando, FL.

Frankel, S.L. and D.R. Maglot, 2001, LOCUSLINK and REFSEQ: Developing tools for genomic annotation and analysis, 221st National Meeting of the American Chemical Society, SanDiego, CA.

DiLorenzo, T, Halper, J, Piccone, MA and **A. Lasky,** 2001, Aging with multiple sclerosis: A preliminary investigation. National Consortium of Multiple Sclerosis Centers, Ft. Worth, TX.

Rivkin, S.Y., Oh, S. and T.A. Bargiello, 2001, Determinants of Vj gating polarity in connexin 32 hemichannels, 221st National Meeting of the American Chemical Society, San Diego, CA.

Goldfischer, R.E., Wencker, D., and R. Kitsis, 2000, Myocyte apoptosis is sufficient to cause cardiomyopathy, 219th National Meeting of the American Chemical Society, San Francisco, CA.

Marton, D., Kang, Y.H., and F. Berthiaume, 2000, Chronic exposure to cytokines suppresses liver-specific function of cultured hepatocytes, 219th National Meeting of the American Chemical Society, San Francisco, CA.

Badrian, C.C., Haspel, J., Friedlander, D., and M. Grumet, 1999, Promotion of neurite outgrowth by regions in human L1, 217th National Meeting of the American Chemical Society, Anaheim, CA.

Blau, L., Babich, H., Zuckerbraun, H.L. and **S.T. Hirsch**, 1999, *In vitro* cytotoxicity of the nitric oxide donor, S-nitroso-N-acetyl-penicillamine, towards cells from human oral tissue, 217th National Meeting of the American Chemical Society, Anaheim, CA.

Feig, J.S., Cleary, J., and B. Diamond, 1999, Detection of estrogen receptor a mRNA in B and T cell lines by reverse transcriptase chain reaction, 217th National Meeting of the American Chemical Society, Anaheim, CA.

Babich, H. and **S.H. Goldstein**, 1988, Bioassays for monitoring the environment: study with arsenics, 9th Annual Meeting, Society of Environmental Toxicology and Chemistry, Arlington, VA.

Ambalu, M. and L. Blau, 1986, The study of ion fluxes across lipid bilayers, 191st National Meeting of the American Chemical Society-7th Student Affiliates Research Symposium, NY, NY.

Gutman, E.A. and L. Blau, 1985, X537A-mediated transport of calcium across phosphatidylcholine bilayers, 189th National Meeting of the American Chemical Society - 6th student Affiliates Research Symposium, Miami Beach, FL [E.A. Gutman was awarded 1st prize, Biochemistry Section].

Blau, L., **Stern R.B.**, Wun, T.C., and R. Bittman, 1984, Calcium transport across phosphatidylcholine vesicles, 8th International Biphysics Congress, Bristol. United Kingdom.

Student Presentations at the National Conference of Undergraduate Research

1998: **Malka Skiba** and **Cheryl Younger**

1995: **Lauren Insel** and **Judy Ehrenberg**

1994: **Yaffa Cheslow**, **Debbie Friedman**, and **Stacey Tuckman**

`The Anne Scheiber Fellowship Program

The Anne Scheiber Fellowship Program provides scholarship support to Stern College undergraduates, as well as graduates, pursing their advanced training at the Albert Einstein College of Medicine. The program, established by Ms. Scheiber through a twenty two million dollar bequest, seeks to support high achieving women with financial need to realize their academic and professional goals. Stern College graduates who attend the University's Albert Einstein College of Medicine may apply for awards up to full tuition for their four years of medical training. We proudly salute the Anne Scheiber Fellows who are fulfilling Ms. Scheiber's dream:

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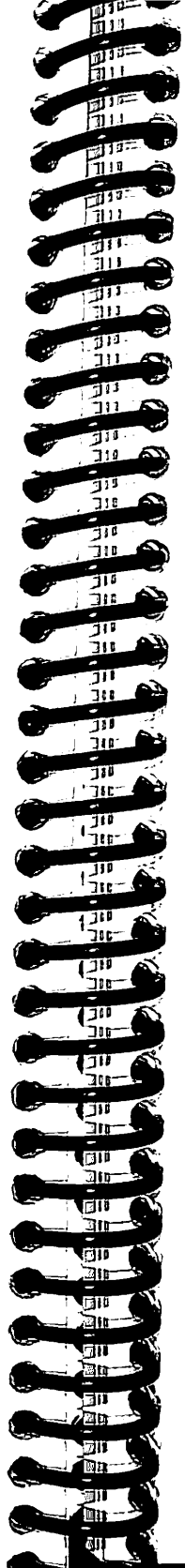

Michelle Kohansieh
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A QUARTER OF A CENTURY OF EXCELLENCE IN TORAH U'MADDA

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Women in Science: Abstracts

Co-Editors:
Sarah Berman and Shani Adest

Unraveling RNA dynamics under HSV-1 infection

By: Shani Adest[1], Yaron Shav-Tal[2], Shani Nadav[2].
[1]Stern College for Women, Yeshiva University New York, NY;
[2]Department of Biomedicine, Faculty of Life Sciences, Bar-Ilan University Ramat Gan, Israel

Herpes simplex virus (HSV) is a common virus with many strains. HSV-1, the most common herpes virus, infects more than 67% of the population under the age of 30. The HSV-1 replication cycle contains both a latent and a lytic phase. In the latent phase the virus infects nerve cells as an extra chromosomal element, with most of the viral genome silenced. The lytic phase is the active infection phase of the virus and contains several steps including penetration, viral gene expression, replication, virion assembly, and release of new virions to adjacent cells. Replication and gene expression of the viral DNA is confined to distinct intranuclear sites known as viral replication compartments (VRCs). Transcription of mRNA undergoes maturation in order to be exported from the nucleus for translation. One of the most important maturation processes the mRNA transcript undergoes is splicing, performed by the 'spliceosome' in which introns are removed and exons are fused together. The spliceosome, a complex of RNA and proteins, along with other splicing factors, are found in nuclear bodies called nuclear speckles. There is a controversy among scientists regarding the role nuclear speckles play in the splicing process. Some scientists theorize that the speckles act as a storage site for splicing factors and their proteins, which migrate to an active gene in which mRNA needs to be spliced. Other scientists theorize that the speckles stay together as a nuclear body and are localized in proximity to active genes, where they are needed for mRNA splicing. Our research was performed under the assumption that the first model is the correct theory.

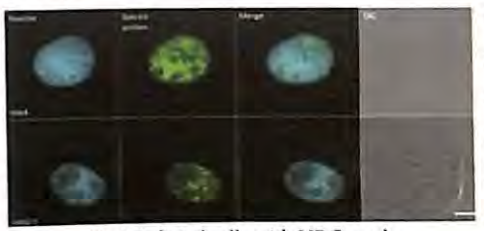

Fig 1: Infected cells with VRCs and speckles in the VRCs

We used cell staining techniques to determine the location of speckles in uninfected cells, as well as in cells infected with HSV-1 virus. In healthy cells, speckles are spread out in the nucleus. However, in HSV-1 infect-

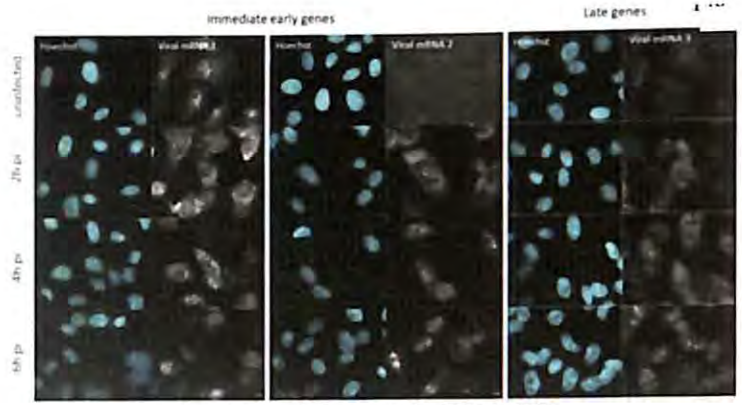

Fig 2: Three different viral mRNA in HSV

ed cells the speckles were found surrounding the periphery of the VRCs, a phenomenon known as localization at the periphery of the nucleus (Fig. 1). Our study aimed to determine why this phenomenon happens with speckles. It is theorized that it may be related to the export of the virus, however, the full function and reasoning has yet to be determined. When the cells were stained with probes to detect the viral mRNA, we were able to see the viral mRNA in the VRCs (Fig. 2). We used 3 different mRNA probes to detect three different viral mRNAs. The HSV-1 virus replication cycle has different stages, with different proteins added at each stage. The first two viral mRNAs stained were of immediate early genes in the cycle, while the third viral mRNA was of a late-stage gene. As the hours post infection increased, mRNA aggregated into large clusters which co-localized with the VRCs. The VRCs are where viral gene expression occurred, therefore possibly accounting for the many viral mRNA at these sites. By the end of the infection, we observed in viral mRNA 1 and 2 bright foci of mRNA at the periphery of the nucleus that appeared as nuclear speckles.

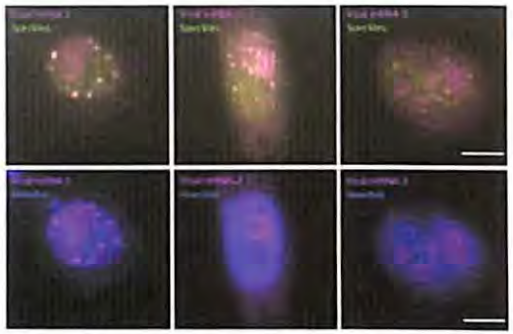

Fig 3: viral mRNA localization in nuclear speckles

Additionally, when the speckles were stained, we see complete co-localization between the speckles and the viral mRNA foci in viral mRNA 1 and 2 but not in 3 (Fig. 3). Viral mRNA 1 and viral mRNA 2 are both immediate early

genes, however, viral mRNA 3 is from a late gene, which explains the difference between them regarding their localization to the speckles. It is still unknown why this occurs. It may be that some mRNA was already transcribed earlier and moved to speckles, and the newer ones are in the VRCs but have not, as yet, been transferred to the speckles. In viral mRNA 3, which is a late stage gene, perhaps more time needed to pass for the mRNA to go into the speckles, or maybe it was not needed in the late stage genes at all. All of these questions are being theorized and analyzed in our research.

The final experiment performed was to analyze how the mRNA acts when the nuclear speckles are dispersed. One way to perform nuclear speckle dispersion is to overexpress the Clk1 kinase. This kinase phosphorylates speckle proteins enabling the speckles components to leave the speckle group to go to a specific gene. Studies have shown that overexpressing that kinase disassembled the nuclear speckles structures. Under these conditions we observed aggregation of mRNA in the cytoplasm (Fig. 4).

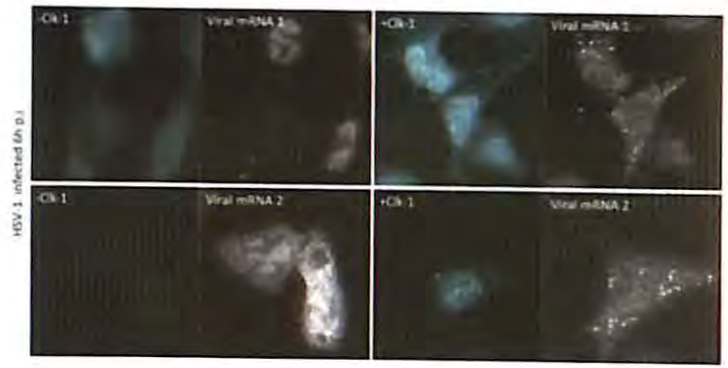

Fig 4: viral mRNA under dispersion of speckle using CLK1

This was the first time we observed aggregation of viral mRNA in the cytoplasm, as opposed to in the nuclear periphery. It is still unclear why this occurred. The aggregation of viral mRNA in the cytoplasm resembled p-bodies, which are cytoplasmic bodies that contain RNA for degradation. Therefore, we theorized that maybe the mRNA is migrating into the p-bodies to be degraded for some unknown reason. Or, it may be that they are not in p-bodies but rather are in some other structure that resembles p-bodies, and for some unknown purpose. Our research aimed to determine what was happening to the mRNA in the cytoplasm and why it aggregated there.

The future experiments of this research will include staining p-bodies to understand the localization of viral mRNA in the cytoplasm under speckles dispersion conditions. The research will continue to discover answers related to the VRCs, speckles, and mRNA under infection conditions, as well as how they relate to each other.

PPM3 and PPL1: Locating the Dopaminergic Neurons that Promote Arousal in the Brain of *Drosophila*

By: Sarah Berman[1], Aabha Vora[2], Andrew Nguyen[2], and Wanhe Li[2]
[1]Stern College for Women, Yeshiva University, New York, NY
[2]Laboratory of Genetics, The Rockefeller University, New York, NY

Research has been conducted with the intension of finding the location in the brain that promotes wakefulness. There are two recent studies that looked for this area in the brain of *Drosophila*, but each study came to a different conclusion. One study (Liu et. al. 2012) found that the PPL1 cluster promotes wakefulness while another study (Ueno et. al. 2012) found that the PPM3 cluster controls the arousal circuit. These contradictory results were noticed and carefully studied by Dr. Wanhe Li and her team, leading to the discovery that both clusters, PPL1 and PPM3 contribute to wakefulness, and ultimately sleep as well, in the fruit fly. [This data is currently unpublished.]

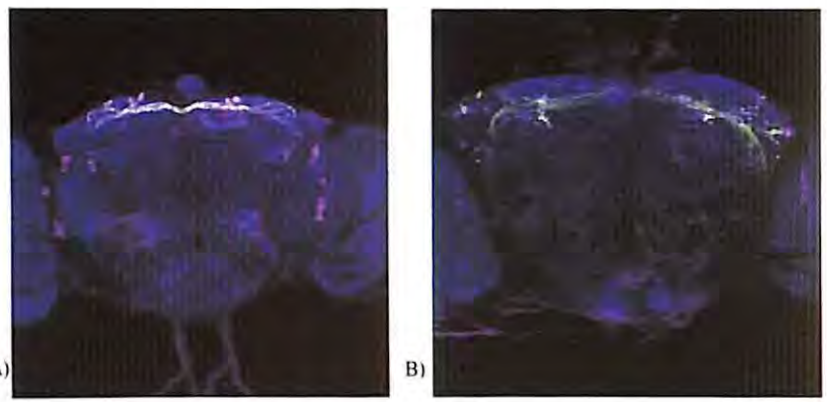

Figure 1 (Li, unpublished)
A) Overlap of neuronal driver SS00650 stained with GFP (green) with cells expressing clock protein timeless (pink). B) Overlap of neuronal driver SS00775 with timeless.

Fly dissections were conducted at times when the clock protein timeless (tim) expression was high (CT22 time points). Then, in a detailed and intensive process, the brains were fixed with paraformaldehyde and stained with GFP, timeless, and nc82 antibodies. A confocal microscope was used to attain the images; Figure 1 depicts one of the brains studied. This shows the activity in the brain during the arousal period, with activity shown in both areas. This discovery enhances our current understanding of the arousal circuit in the brain and ultimately our overall knowledge of the sleep-wake cycle at large.

The Search for a Targeted Therapy for Triple-Negative Breast Cancer

By: Natania Birnbaum[1], Elisheva Miller[1], Esther Miller[1], Rachel Khaimchayev[2], Shana Erblich[3], Dr. David Musheyev[1], Dr. Anya Alayev[1]
[1]Stern College for Women, Yeshiva University, New York, NY; [2]Adelphi University, Garden City, NY; [3]Rutgers University of New Jersey, NJ

Breast cancer is one of the most common cancers worldwide. According to the National Breast Cancer Foundation, in the United States, 1 in 8 women in their lifetime will be diagnosed with breast cancer. The fatality rate for breast cancer is about 2.6%, meaning about 1 in 39 women diagnosed with breast cancer will die from it. While tremendous progress has been made in cancer treatment over the last century, breast cancer is a highly heterogeneous disease, and treatment options for some types lag significantly behind.

Breast cancer is divided into categories based on the expression of distinctive markers in the cells. Estrogen receptor positive (ER+) cancers express estrogen receptors, while estrogen receptor negative (ER-) cancers do not. ER+ cancers are further classified based on the presence or absence of progesterone receptors and the HER2 protein. Therapies exist that target all three of these markers, including monoclonal antibodies as well as traditional chemotherapeutic drugs.

A relatively small, but still considerable, proportion of breast cancers lack all three of these markers. This is a phenomenon known as triple-negative breast cancer (TNBC), a subset of ER breast cancer which accounts for roughly 15%-20% of newly diagnosed cases of breast cancer. This type of breast cancer is much harder to treat than other breast cancers, since no targeted therapies exist against it and it is resistant to chemotherapy. In addition, TNBC tumors are usually more aggressive and recur frequently. All this taken together means a poorer prognosis for those with TNBC than other types of breast cancer.

While TNBC lacks the targets of all current targeted treatments against breast cancer, it does express a distinctive marker of its own, estrogen-related receptor alpha (ERRα). It is an orphan nuclear receptor; that is, it is homologous to another receptor, but has no known ligand. In ERRα's case, it is similar to estrogen receptor alpha (ERα), but plays a different role in the cell. While ERα is associated with gene expression in proliferation, ERRα regulates transcription of enzymes involved in metabolism. ERRα expression is inversely correlated with ERα expression in ER+ cells, due to the process of ERα synthesis inhibiting ERRα expression. Therefore, ERRα levels are often low in ER+ cells, and elevated in TNBC and other ER- cells.

Evidence exists for cross-talk between ERRα and the MAPK (mitogen-activated protein kinase) pathway, which regulates cell survival, proliferation, and apoptosis. The pathway is activated by growth factors that bind to receptor tyrosine kinases, which propagate a signal through phosphorylation of successive kinases that eventually reaches transcription factors in the nucleus. The kinase that transfers the signal across the nuclear membrane is called ERK, and high levels of pERK (phosphorylated ERK) indicate that the pathway is active and causing cell growth and proliferation. Previous studies done in our lab show that TNBC cells treated with the ERRα antagonist XCT-790 have elevated levels of pERK. The same upregulation of pERK has been observed in TNBC cells treated with tamoxifen, a selective estrogen receptor modulator that inhibits estrogen receptors in breast tissue. This hints that tamoxifen may have some ER independent mechanism, especially considering that literature has indicated that ER- cells with high ERRα expression can be made sensitive to tamoxifen.

While high levels of pERK are undesirable in cancer cells (as an active MAPK pathway is a mark of survival), the correlation implies a possible link between ERRα, tamoxifen, and the MAPK pathway.

In order to investigate this, the cytotoxic effects of XCT-790, tamoxifen, and the MAPK inhibitor U0126 were measured in TNBC cells, both individually and in combination. U0126 inhibits the activity of MEK1/2, kinases upstream of ERK in the pathway, which would lower the amount of pERK in the cell and thus counteract that effect of XCT-790 and tamoxifen.

The Neutral Red assay was conducted over the course of a week with MDA-MB-231 and MDA MB-436 cells, both cell lines derived from human TNBC tumors. The cells were treated with XCT-790, tamoxifen, U0126, and all combinations of two drugs. Tamoxifen produced no change from control, but XCT-790 and especially U0126 exhibited sig-

nificant cytotoxicity. In particular, XCT-790 combined with U0126 resulted in nearly a 50% reduction in the cell population, more than either of those two drugs on their own. These results show that counteracting the upregulation of the MAPK pathway does not inhibit the anti-ERRα activity of XCT-790, and that targeting ERRα in tandem with the MAPK pathway can be used as an effective strategy against TNBC.

Using UV-Vis Spectrophotometry for the Optimization of the Conditions of G-quadruplex MP-11 Complexation Reactions

By: Mili Chizhik[1], Nurit Adiram[2] and Eyal Golub[2]
[1]Stern College for Women, Yeshiva University, New York, NY;
[2]Department of Chemistry, Bar Ilan University, Ramat Gan, Israel

The interactions between nucleic acid sequences and proteins are of utmost importance for life sustaining processes in all organisms. However, each interaction requires a different set of environmental conditions, surroundings, and wide-ranging molecular resources to successfully complete the desired mechanism. One such example of a protein interacting with a sequence of nucleic acids is the guanine-rich quadruplex that binds with different types of proteins.

Guanine-rich quadruplexes, or G-quadruplexes, is one example of a nucleic acid secondary structure. The G-quadruplex is made from a tetrad of guanines that interact via π-π stacking and Hoogsteen-type hydrogen bonds. [1] The structure is further stabilized by monovalent metal ions, primarily potassium ions (K+), that are positioned in between the tetrads. The topology of the G-quadruplex varies greatly and can fold either into parallel, antiparallel, or hybrid structures and can form either inter- or intramolecularly. [2] The topologies can be identified by various biophysical methods via the analysis of the circular dichroism spectrum of each sequence and compared with known signals that are distinctive of the specific topologies.

Microperoxidases are heme-containing catalytic peptides that break down the cellular respiration's byproduct of hydrogen peroxide, and they have been determined to be the products of the proteolytic breakdown of cytochrome c, with microperoxidase-11 (MP-11) being the most well-known heme-peptide. [3] This eleven amino acid heme-peptide is bound to a metalloporphyrin through the coordination of the histidine-18 residue and the iron cation.

This research is repurposing MP-11 to be a model for the G-quadruplex-microperoxidase interactions while also creating a simpler way to monitor the complexation reaction. This is because heme has characteristic spectral changes that accompany the complexation of itself and G-quadruplexes. G-quadruplexes are biochemically relevant and their interactions with

MP-11 have not yet been closely examined; therefore, the optimization of the environmental conditions of the different reactions must first be achieved to continue to explore these compounds. The results from varying the buffer solutions used can illustrate the interactions between the solvent components and the aggregation of the MP-11, as well as the complexation with G-quadruplex. However, the varying of the G-quadruplex sequences will demonstrate how closely binding the G-quadruplex-MP-11 complex is and the specificity of the sequence based on its topology.

Initially the MP-11 was added to the solution and then once the G-quadruplex was added, the histidine residues and positively charged iron cation in MP-11 bound to the negatively charged G-quadruplex sequence and the height and width of the peaks varied depending on sequence and buffers used, as predicted. One of the two spectral peaks can clearly be seen, and the height and width vary with the different solute and solvent conditions. For example, one can see two peaks in Figure 1, one associated with the MP-11 aggregation prior to the addition of the G-quadruplex and the second peak is associated with the G-quadruplex-MP-11 complex.

The peak not shown in the figures corresponds to the charge-transfer peak for the complex. The hyperchromicity of the shown peak is an indicator of the hydrophobic nature of the interaction between the MP-11 and the G-quadruplex. Similarly, one can see the varying nature of the complexation reactions with the different G-quadruplexes and buffers in Figures 2 and 3.

Through the optimization of the complexation reactions, one can utilize the data obtained to further our understanding of the interactions between the G-quadruplex and the MP-11. Since G quadruplexes are prevalent in the telomeric regions of the chromosomes and the promoter region within the oncogenes, they have a very important role in transcriptional regulatory processes and anti-cancer treatments, such as chemotherapy and drugs with high selectivity. Thus, researching the optimal conditions under which we can identify and select for the G-quadruplex can have major basic and translational science and clinical applications especially into the molecular basis of thedevelopment of diseases.

Figure 1: UV-Vis Absorbance Spectra of MP-11 with and without G-quadruplex 532 in HEPES Buffer. Two peaks can be seen in the absorbance spectra: the orange-colored peak represents the absorbance associated with the aggregation of the MP-11, whereas the grey-colored peak is the peak associated with the complexation of the 532 G-quadruplex with MP-11. Above the spectra, a simplified illustration of the complexation reaction can be seen with the arrows pointing to the corresponding peaks.

Figure 2: UV-Vis Absorbance Spectra of MP-11 with G quadruplex 532 and Tris, HEPES, and PBS Buffers. Four peaks can be seen from the different complexation reactions in the different buffers.

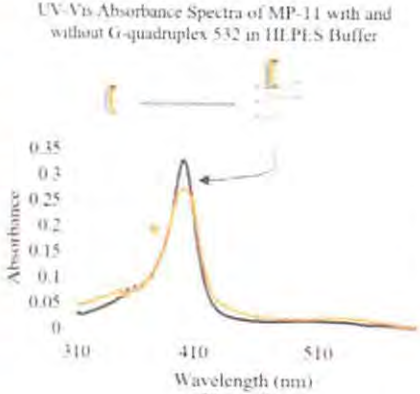

Figure 1

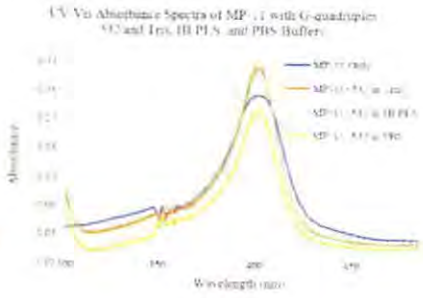

Figure 2

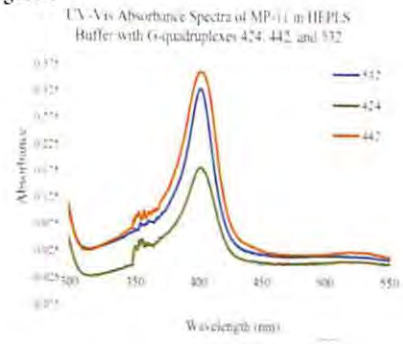

Figure 3

Figure 3: UV-Vis Absorbance Spectra of MP-11 in HEPES Buffer with G-quadruplexes 424, 442, 532. The three peaks shown in the spectrum correspond to different G-quadruplexes used and illustrate the difference in complexation characteristics of their unique topologies.

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Influence of Chemotherapy on the Microbiome and Immunological Functioning of the Gut

By: Eliana Farkas[1], Sivan Amidror[2], Shalhevet Azriel[2], Ariel Simon[2] and Nissan Yissachar[2]
[1]Stern College for Women, Yeshiva University, New York, NY;
[2]Department of Life Sciences Bar Ilan University, Ramat Gan, Israel

Chemotherapy is one of the primary treatments used to treat cancer. Chemotherapy targets the body's dividing cells, with the hopes being that metastasizing cells will incur most of the damage. However, often, patients experience severe side effects when the chemotherapy targets one's own body. Our body contains a large population of microorganisms, collectively termed the microbiota. This population of beneficial bacteria are critical for basic functioning, such as digestion, protection from other harmful microorganisms, regulating the immune system, and more. Changes to the composition of the gut microbiota (called dysbiosis) is associated with the development of auto-immune diseases, inflammation and cancer. Based on the critical role of the microbiota in regulating immune system function, **we hypothesize that the chemotherapy disrupted, dysbiotic microbiota participate in the development of chemotherapy-associated inflammation.**

There are several possible theories that can be used to explain how chemotherapy induces the permeability of the gut that leads to symptoms like mucositis. Chemotherapy was shown to directly destroy the cells in the epithelial lining of the gut-- cells which are constantly dividing and replacing themselves. This increases gut permeability and induces leaky gut syndrome. Secondly, chemotherapy may potentially alter the gut microbiome in the lumen, allowing the proliferation of more harmful types of bacteria that are more likely to penetrate the tight junctions between the epithelial cells. Previous findings in the lab found that post-chemotherapy microbiota alters gut barrier functions, compared with pre-chemo microbiota collected from the same mouse/patient. This is likely a result of some altered bacteria.

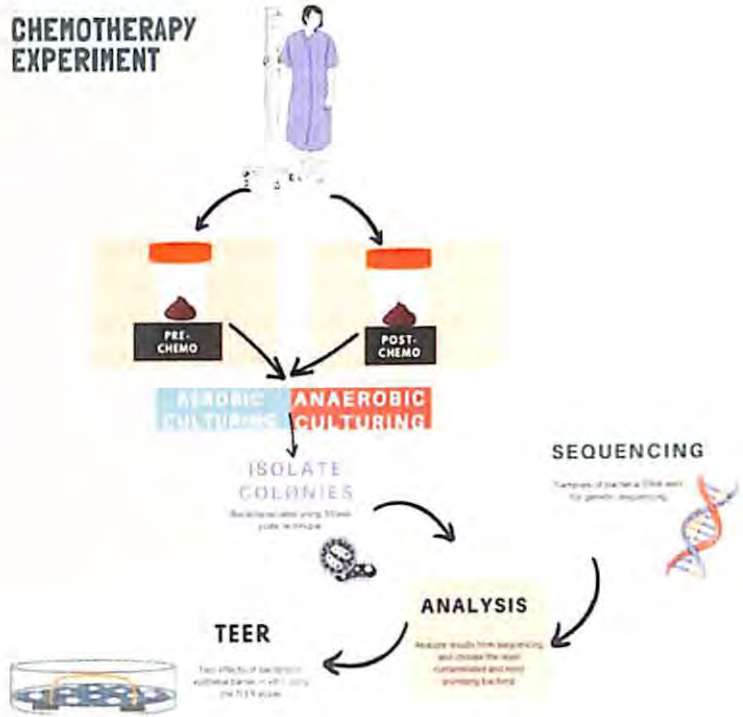

Figure 1. Flowchart of chemotherapy experiment procedure

The aim of this experiment is to isolate bacteria from breast cancer patients before and after chemotherapy, to analyze changes to the microbiome and assess their potential exacerbation or therapeutic influence on the epithelium. To accomplish this, fecal samples were collected from breast cancer patients, before and after chemotherapy. The bacteria were cultured and isolated, their genetic material was amplified via PCR (polymerase chain reaction) using primers for the bacterial 16s ribosomal RNA gene, and then sent to sequencing for genetic analysis. The lab will then use the TEER assay to assess the bacteria's altered influence on the tight junctions in epithelial cells. While research is still ongoing, we are hopeful about our hypothesis, and our results thus far have been promising.

Masked Communication

By: Shira Joshua[1], Dr. David Anaki[2]
[1]Stern College for Women, Yeshiva University, New York, NY;
[2]Cognitive Neuroscience Lab, Department of Neuroscience, Bar Ilan University, Ramat Gan, Israel

Throughout the duration of the COVID-19 pandemic, many countries required the use of face masks in all public locations. Masks cover most people's faces, leaving only the forehead and eyes visible. The study conducted analyzed the potential impact that masks have on people's perception and recognition of facial expression.

Previous studies have shown that it is harder to detect emotions relying solely on the eyes. This experiment intended to test those findings in relation to the COVID-19 pandemic. In the experiment, we presented five different conditions of individuals: full face; half face; mask on chin, only; face mask; and scarf. For every condition we presented six expressions (five of Ekman's basic emotions): happiness, sadness, anger, fear, disgust and neutral. The recognition of emotions in facemask and full-face conditions were compared between the different participants and analyzed for replication purposes. In addition, this experiment would address the question whether the type of mask used influences facial emotion perception by comparing the half face condition to the scarf and face mask conditions. Additionally, we hypothesized that the mask condition would be associated with COVID-19 related emotions such as fear or disgust.

The experiment was conducted using E-prime. In total there were 720 different pictures divided into 4 separate studies with 180 pictures each. Each version would randomly assign each picture in an order. We recruited N=40 young adults: half women and half men. The pictures were presented on a screen and participants had to select what they perceived as the correct emotion.

Results presented a difference of 0.095 for emotional recognition between full face and a cover: scarf, mask, half face, (Figure 2). In combining all conditions together, the scale presents the following expressions from high to low: happy, neutral, fear, anger, sad and disgust. (Figure 3). With the mask condition (Figure 4), the expression of happiness was the easiest to

detect, while fear was second and disgust was last. Prediction for the mask condition was to be associated with COVID related emotion such as fear and disgust. In fact, fear was highly correlated with masks, however, disgust scored the lowest average. Additionally, it is interesting to note that on average, disgust was significantly lower than the other expressions (Figure 1).

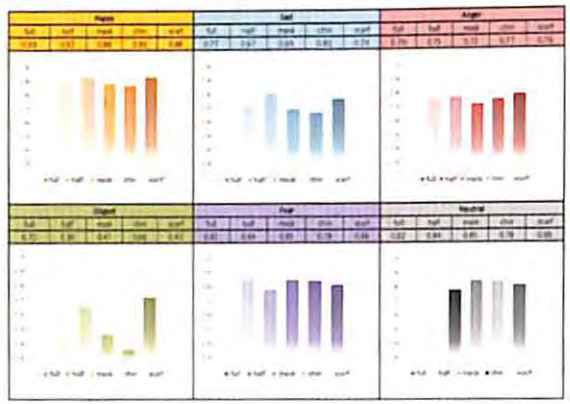

Figure 1: Happy, neutral and fear were the emotions easiest to detect. Whereas anger, sadness, and disgust were the least detected respectively.

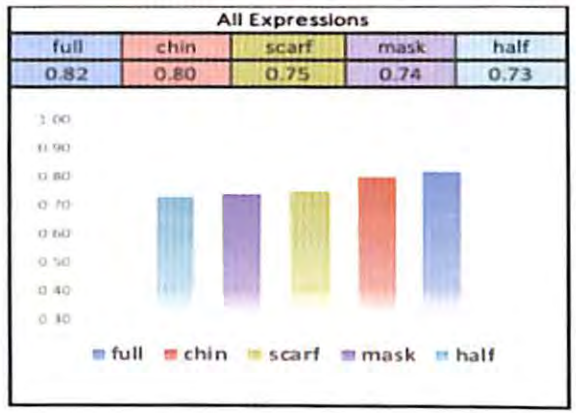

Figure 2: When combining all expressions, the detection from high to low of the different conditions was: full, chin, scarf, mask and half.

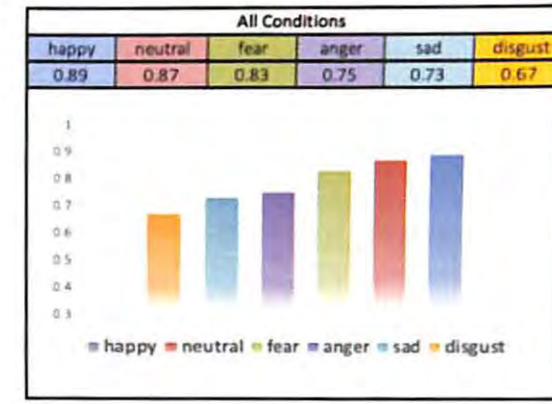

Figure 3: When combining all conditions, the detection of all expressions in the order of high to low was: happy, neutral, fear, anger, sad and disgust.

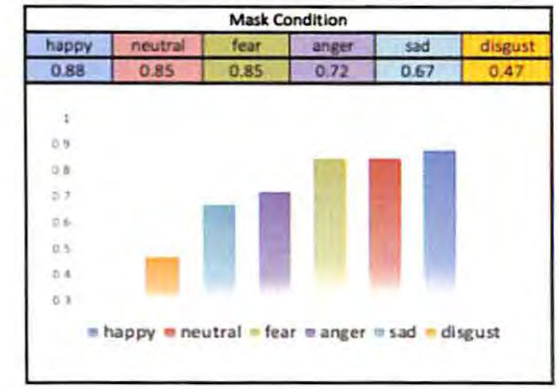

Figure 4: By combining the mask condition in all expressions, the order of detection from high to low was: happy, neutral, fear, anger, sad and disgust.

Down-regulation of Kap1 in Testicular Sertoli Cells Causes a Decrease in Protein Sumoylation and Initiates Apoptosis.

By: Tania Kiesel1, Kayla Perlmutter[1], Shanza Baseer Tariq[2], Manveet Nanda[2], Dr. Amitabha Sengupta[3], and Dr. Margarita Vigodner[3]
[1]Stern College for Women, Yeshiva University, New York, NY;
[2]Biotechnology Management and Entrepreneurship, Yeshiva University Katz School of Science and Health, New York, NY;
[3]Department of Biology, Stern College for Women, New, NY

Out of all the couples in the United States, infertility affects 8-12% and about 50% of these couples are infertile due to the male partner. Additionally, 30-50% of the male infertility cases occur for an unknown reason. However, one significant cause of male infertility is damage to spermatogenesis, the process which forms male sperm. Researching the regulation of spermatogenesis can help identify reasons for specific cases of male infertility and may lead to discovering targets for male contraception.

Testicular somatic cells, known as Sertoli cells, support sperm formation. These cells are crucial for spermatogenesis and generate critical hormones and growth factors. Spermatogenesis and the many roles of Sertoli cells are assisted by post-translational modifications which happen on cellular proteins after they have been synthesized.

The Vigodner lab focuses on SUMOylation, a post-translational modification which occurs via the addition of small ubiquitin modifiers (SUMO) to target proteins. One enzyme that regulates SUMOylation is called KAP1 (KRAB-associated protein-1). The Vigodner lab chose to specifically study KAP1 in Sertoli cells due to its role in regulating SUMOylation in granulosa cells. Also, the Vigodner lab chose KAP1 because it is highly expressed in the testis and it colocalizes SUMO in Sertoli cells. The Vigodner lab hypothesized that KAP1 regulates SUMOylation in Sertoli cells. To support this, the lab used small inhibitory RNAs (siRNAs) to down-regulate KAP1 and then checked the levels of SUMOylation in addition to the viability of the cells.

Sertoli cell lines were transfected with KAP1 siRNAs followed by protein isolation. After the concentrations of proteins were evaluated using bicinchoninic acid assay, the western blots were executed to test

the amount of KAP-1 and SUMOylation. As identified in Figure 1, in the presence of KAP-1 siRNsA, the protein expression of KAP-1 was substantially diminished as contrasted to the ones without the siRNAs. These outcome mean that KAP-1 was notably down regulated.

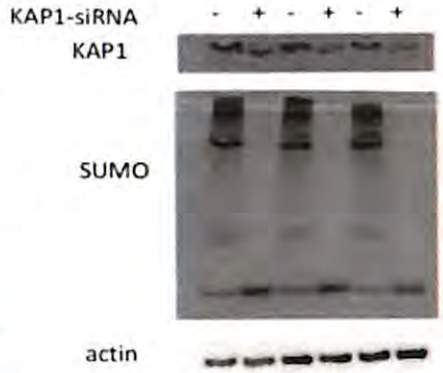

Figure 1: Western blot analysis of KAP1-siRNA, SUMO proteins and actin.

In the KAP-1 down-regulated samples, there is no SUMOylation detected as compared to the control wells. At the bottom of the blot, there is more free SUMO seen in the samples with the down-regulated KAP1. This suggests that SUMO could not conjugate to the target proteins. We used an actin antibody on the same blot in order to confirm equal loading of the sample. Therefore, from this blott, KAP1 seems to play a significant role as a SUMO ligase in Sertoli cells.

Succeeding the down-regulation of KAP-1, the viability of the cells were checked using Caspase-Glo Assay, that measures the level of apoptosis, and Water-Soluble Tetrazolium salt (WST-1) assay, to check cell viability. The measurements for the both assays were collected using a Promega GlowMax microplate reader that can detect both absorbance and chemiluminescence (Figure 2).

Figure 2

In Figure 3, a meaningful decrease in the cell viability is detected in the samples with KAP-1 siRNA. And in Figure 4, in the Caspase-Glo assay, we recognize a major increase in caspase level for the cells that were transfected with the high doses of the KAP-1 siRNA.

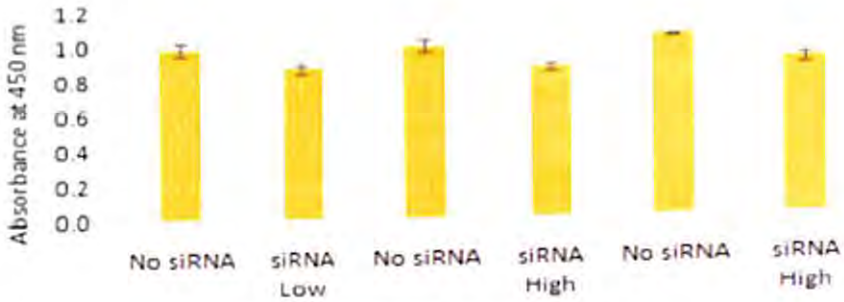

Figure 3: Treatment of Mouse SE by KAP1 siRNA on WST-1 Assay

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Figure 4: Treatment of mouse SE by KAP1 siRNA on Caspase-Glo Assay

In conclusion, a down-regulation of SUMO conjugation to its target proteins was observed when KAP1 was inhibited. This proves KAP1 regulates SUMOylation in Sertoli cells and suggests it can act as a SUMO ligase. Also, down-regulating KAP1 can affect the Sertoli cells viability and initiate their apoptosis. These results provide a foundation to delve into mice studies where SUMOylation and KAP1 activity will be inactivated in the Sertoli cells. Furthermore, biopsies of testicular cells from infertile male patients can be tested for SUMOylation levels in addition to screenings for mutations in KAP1 SUMO ligase activity site.

The Structural Organization of the CopY Metalloregulator

By: Yael Laks[1], Melanie Hirsch[2] and Sharon Ruthstein[2]
[1]Stern College for Women, Yeshiva University, New York, NY;
[2]Department of Chemistry, Bar Ilan University, Ramat Gan, Israel

Keeping organisms in a proper state of homeostasis is critical in order to maintain survival. Specifically, metal ions such as copper, in appropriate concentrations promote necessary cellular processes. The copper cycle plays a crucial role in prokaryotes because copper ions are required as cofactors for enzymes that catalyze oxidation reduction reactions, as well as assisting in regulating DNA transcription within the cell. When proteins involved in the cycle bind to the specific metal ion, it induces changes in structure which either promotes or prevents DNA binding and therefore, regulates the transcription process. In high concentrations, metal ions are proven to be lethal to organisms. Therefore, the Ruthstein lab is studying a more thorough understanding of the biological pathways of copper in order to ensure copper homeostasis in bacteria. Through EPR and computational modeling, a proper structure-function understanding of the systems will eventually aid in the future development of inhibitors. These inhibitors could be ultimately incorporated into a new generation of antibiotics. These drugs will expectantly work to kill the bacteria while ensuring the safety of another organism's host.

Under the guidance of Melanie Hirsch, the function and efficacy of the copper metalloregulator, CopY is analyzed in S. *pneumoniae*. Metalloregulators are transmembrane or cytoplasmic proteins that bind to specific metal ions with high affinity and play a role in regulating the concentration of the ions within the cell. CopY, a transcription factor, is able to induce or repress the expression of specific genes through metal binding. Structural information is lacking for this protein in *S. pneumoniae*, limiting the ability to elucidate the mechanisms of function. Although it has been previously identified and characterized in *Enterococcus hirae*. In past research determined by NMR spectroscopy, the DNA binding domain was identified as a canonical winged-helical motif. CopY from S. *pneumoniae* has three Cys residues which can be spin labeled. (Figure 1)

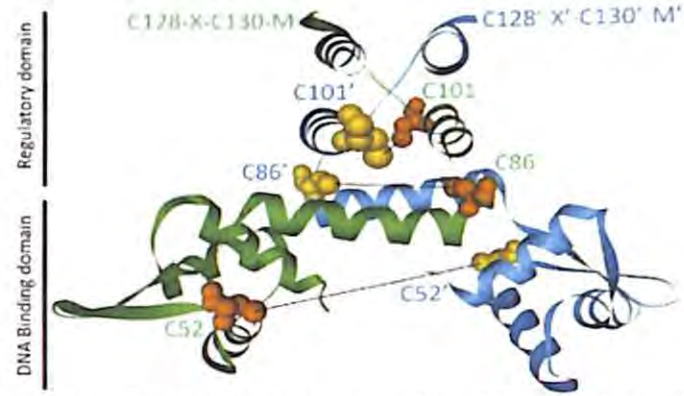

Figure 1: *S. pneumoniae* CopY protein model structure. The model was created with SWISS-MODELELR based on the methicillin regulatory protein (PDB 1OKR). Cysteine residues that are available for spin labeling to EPR measurements are marked.

Naturally, CopY is a dimer that either binds Cu(I) ions or binds to Zn (II) in a repressor state. At a certain threshold concentration of copper in the cell compared to zinc, two molecules of Cu(I) will replace the zinc molecule. The protein adapts its conformation and releases the DNA binding site, expressing the DNA strand attached. If the DNA is expressed, a feedback mechanism loop occurs by translating copper chaperones CupA and Cu-effluxes CopA, which are involved in restoring proper copper concentrations within the cell.

Before I came, the wild type protein was previously expressed. The research I became involved with began by studying mutations on the wildtype at position C86. In order to obtain the protein structure and function, biomolecular techniques such as PCR, Ni resin protein purification, EMSA and crosslinking were performed. (Figure 2)

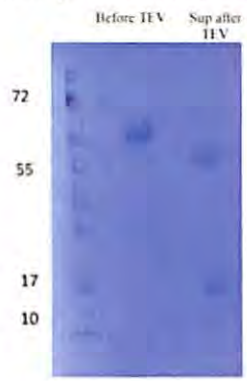

Figure 2. Gel image of purified protein once cut with TEV

In order to study the protein structure and behavior with varied concentrations of Cu(I) and Zn (II), the Ruthstein lab uses electron paramagnetic resonance (EPR) spectroscopy. A type of EPR used is continuous wave (CW) spectroscopy. The protein was spin labeled with MTSL, a nitroxide paragmentic probe that can be attached to cysteine residues in the protein. This was done in order to confirm the protein was spin labeled correctly. Additionally, dynamics of the side chains changed. This means the ion is bound and a change from the wild type was observed. (Figure 3) Based

on the peaks, when concentrations of copper and zinc varied, a change in the dynamics of the side chains additionally changed. In addition to CW, double electron-electron resonance (DEER) will be utilized. DEER is a type of pulsed EPR spectroscopy. This works through isolating the electron-electron dipolar interaction between two spin probes stimulated by a set of pulses. Data obtained can be used to extrapolate calculations that can measure distances at the nanometer range 1.5-8.0 nm. This approach is valuable and distinctive as it can study proteins with different sizes, informing about the inter-monomer distance and changes. In order to observe if the protein changed once the specific mutation was done, the distance between C86' and C86 will be measured.

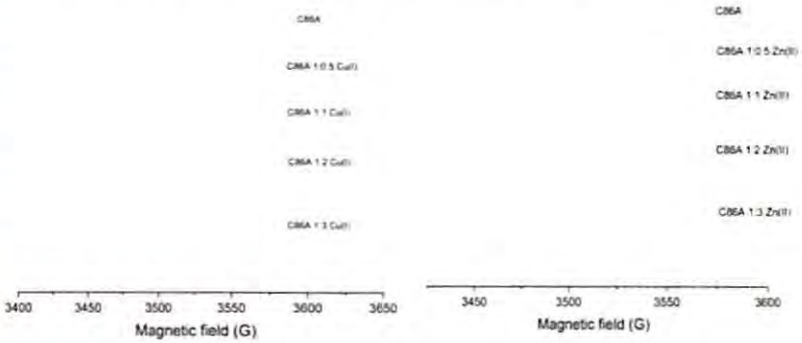

Figure 3. CW EPR spectroscopy graphs. Left is Cu (I), right is Zn (II).

Combining these biomolecular techniques and computational modelling, the protein general structure and function can be solved.

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Generic Description of Many-Body Quantum Systems with Banded Random Matrices

By: Tamar Leiser[1], Leon Alper[2], and Lea F. Santos[1]
[1]Physics Department, Stern College for Women, Yeshiva University, New York, NY [2]Physics Department, Queens College, CUNY, Flushing, NY

Quantum mechanics focuses on the study of tiny particles such as electrons or photons and the systems made up of such particles. The theory of quantum mechanics is an intrinsically probabilistic one, which leads to certain unique properties. For instance, according to the uncertainty principle, one can either know the position or the velocity of a particle at any given time with precision, but not both. We can also find a particle in a "superposition" of more than a single state, where the particle can exist in any state and only takes a stand when observed. For example, in this project we studied systems comprised of qubits, or quantum bits. Just like a bit in a classical computer, the qubit has two possible states: it can be in a state of 0 or a state of 1. However, due to the probabilistic nature of quantum particles, a qubit can also be in a superposition of both states. If we prepare a chain of qubits in a certain initial state, let's say $|1010\rangle$, the state evolves over time and becomes a superposition of all possible states: $a1|1100\rangle + a2|1010\rangle + a3|1001\rangle + a4|0110\rangle + a5|0101\rangle + a6|0011\rangle$, where $|ak|2$is the probability of finding each configuration once the system is observed. While this chain with only 4 qubits may not be too difficult to analyze by itself, quantum systems can be made up of many, many interacting particles. This makes real systems more complex and therefore more difficult to study. The purpose of this research project was to try to find a way to generalize our system of interacting qubits using simpler matrices of random numbers, which would allow us to better describe these quantum systems and apply the generalization to other models as well.

The systems our work focuses on are one-dimensional spin-1/2 lattices described by the Heisenberg model. A spin-1/2, just as a qubit, has two possible states: pointing up or down along a magnetic field. We refer to the spin pointing up as the excitation, which, due to the couplings between the spins, can move along the system. A one-dimensional lattice, also known as a chain, can either be in a line (open) or a ring (closed). In an open chain there exists a border effect, where the sites on the end behave differently

than the rest because the excitations can only move to its one neighbor. In a closed chain, however, the first and last sites in the chain can interact, removing the border effect previously seen. These chains can be analyzed using the Hamiltonian that describes the system, which is an operator consisting of all the energy present in the system, both kinetic and potential. Once a basis is chosen, the Hamiltonian is put in a matrix form. Its non-zero elements come from the energies that make up each configuration of the chain. When the system has on-site disorder, additional energy from each site contributes to the matrix. Once we have this Hamiltonian matrix, we can diagonalize it to extract the discrete energies of the system.

While the Heisenberg model represents real quantum systems, we can also create a general matrix using random numbers that resembles the Hamiltonian but doesn't represent any specific system. Just like the Hamiltonian matrix of a real system, our random matrices must be symmetric and banded, meaning that its non-zero entries are confined to a certain sized diagonal band on both sides of the main diagonal. For this project we focused on closed Heisenberg spin-1/2 chains with on-site disorder and banded random matrices. The goal of our research was to see if we could find a more general way to describe complex many-body quantum systems as those represented by the Heisenberg model. If we can mimic realistic systems with the simpler random matrices, we may be able to use analytical means, as opposed to computational, to solve these systems.

We first wrote a computer code using Mathematica to create the Hamiltonian matrix for a closed chain with on-site disorder and different parameters of the system. We then considered a system with 10 sites and 5 up-spins, and diagonalized the corresponding Hamiltonian matrix of dimension 252 to obtain the eigenstates and eigenvalues of the system.

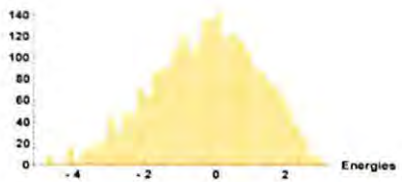

Fig. 1: Histogram of eigenvalues across 10 realizations of closed chain with on-site disorder

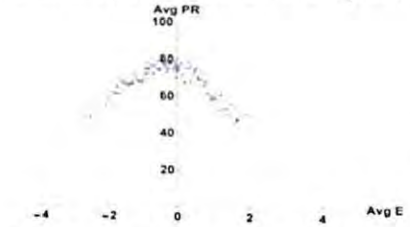

Fig. 2: Average participation ratio for each energy level across 10 realizations of closed chain with on-site disorder

Using this information, we analyzed the distribution of the energies of the system (see Fig.1) and the average participation ratios of each energy level (see Fig.2) across multiple realizations of the system.

Our next step was to write a computer code to create banded random matrices of dimension 252 with increasing band sizes and conduct the same analysis as before to compare the results with those from the real system in Fig.1 and Fig.2. The goal was to find which band size, if any, gives results like those of the Heisenberg Hamiltonian. This process gave us results such as the ones below in Fig.3 and Fig.4, which are from a random matrix with a band size of 151. We discovered interesting aspects of the banded random matrices that require further analysis, such as a dip in participation ratios around zero that becomes more pronounced as the band size is increased (see Fig.4). We also see in Fig.3 that the energy distribution does not have a Gaussian shape, as seen in Fig.1, but is closer to a semicircle, which is typical of full random matrices.

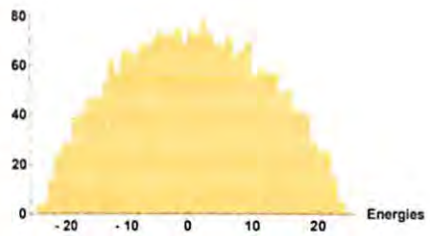

Fig. 3: Histogram of eigenvalues across 10 realizations of random matrices with band size of 151

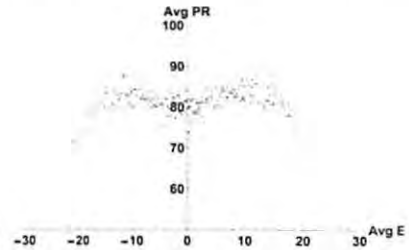

Fig. 4: Average participation ratio for each energy level across 10 realizations of random matrices with band size of 151

Although some band sizes gave results close to those of the Heisenberg chain, none were similar enough to be of significance. The next step will be to introduce sparsity into the random matrices and to change the levels of randomization to try and mimic the real system more closely. This will hopefully bring us closer to recreating the results of the closed chain, thereby allowing us to generalize these complex systems for future use.

Establishment of hPSC-based Model for Congenital Kidney Disorder

By: Sarah Liberow[1], Daniella Genet[2], and Dr. Achia Urbach[2]
[1]Stern College for Women, Yeshiva University, New York, NY; [2]The Mina & Everard Goodman Faculty of Life Sciences, Bar Ilan University, Ramat Gan, Israel

Congenital anomalies of the kidney and urinary tract, or CAKUT, is a genetic condition that occurs in 1 in 500 live births and accounts for 35% of end-stage kidney disease in children. Most cases of CAKUT stem from disruption of the highly intricate process of organogenesis, leading to defective renal structures. While some mutations have been identified that cause CAKUT, my lab is studying a novel mutation in Gene X, identified in a single young patient suffering from cystic renal dysplasia. Gene X is implicated in the Wnt pathway and was previously not linked to CAKUT. My work focused on preparing human stem cell lines to closely model the disease as its capacity for self-renewal and ability to adopt any cellular fate make it ideal to study a monogenic disorder such as in Patient X. In order to study loss-of-function of Gene X in human pluripotent stem cells (hPSCs), we explored utilizing the CRISPR-Cas9 system to edit the stem cells' genome. Through both nonhomologous end-joing (NHEJ) and homology-directed repair (HDR), we were able to both create a double knockout of Gene X and work toward inducing a targeted mutation, respectively.

Using nonhomologous end-joining (NHEJ), my lab had edited human embryonic stem cells (hESCs) to knockout Gene X and create partial or complete loss-of-function. In order to differentiate between heterozygous and homozygous knockouts, I extracted and then tested for the protein in the unknown lines versus wild-type and known heterozygotes by performing a Western blot. No protein was visualized in the unknown samples after development with α GeneX, while there was protein at the appropriate molecular weight (MW) in the wild-type and heterozygous cells (Figure 1). To confirm that absence of Protein X was due to a double knockout of Gene X, and not due to mishandling of the samples, I developed the Western with α tubulin to confirm that there was approximately the same amount of housekeeping genes across all samples (Figure 1). Therefore, the evidence supports that the unknown lines are homozygous for the knockout of Gene X.

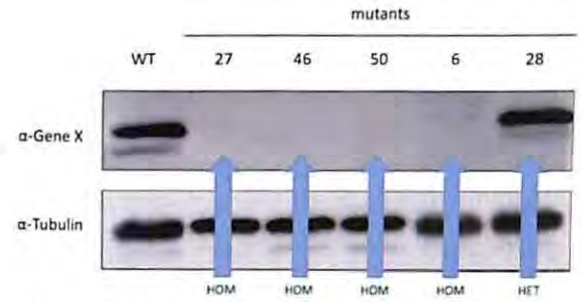

Figure 1. Western blot performed to determine presence of studied protein. No Gene X protein visible in the unknowns and in known homozygous knockout #6. Tubulin is visible in all samples.

Now that we have identified double knockouts for Gene X, the next step was to induce a targeted mutation matching that of our patient so as to compare disease models most closely aligned with the patient. We needed to ascertain which guides would lead CRISPR-Cas9 to cut at the correct location upstream of Gene X, which would be followed by homology-directed repair utilizing a template with a deletion of 4 base pairs in Gene X. My experiment aimed to determine which guide would be the best for this process. I transfected HEK 293T cells with three different guides, as well as a control with GFP to monitor if the transfection was successful. After one day, GFP was visible under fluorescent microscope in about 80-90% of cells, supporting that the transfection had taken place (Figure 2). After extracting and sequencing DNA from the three samples as well as from an additional H9 control, we saw that two out of the three guides were effective at finding and cutting the correct PAM site (Figure 3).

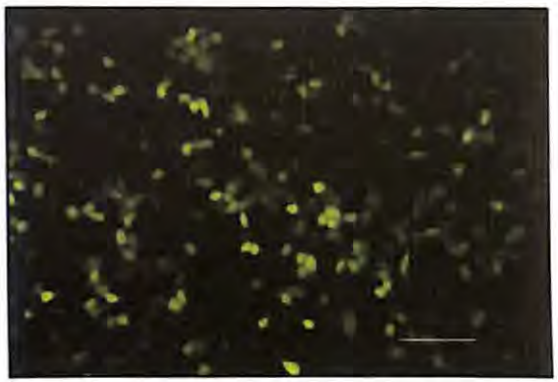

Figure 2. HEK 293T cells control transfected with GFP visualized under fluorescent microscope at 20x.

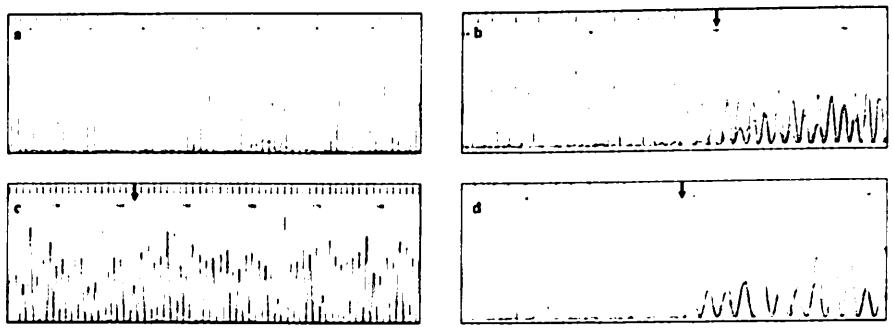

Figure 3. Sequencing data retrieved from transfection. A) H9 control. B-D) Experimental guides

By confirming both heterozygous and homozygous knockouts as well as beginning to identify guides to induce a targeted mutation, our research enables us to learn more about the pathology of this disease and is a step in the development of disease models for Gene X. Using these disease models, we can picture CAKUT in vitro which allows for deeper understanding of this novel mutation that causes CAKUT and an expansion of our knowledge on its mechanisms.

The 20S Proteasome Degrades the CARD8 Inflammasome-Forming Protein

By: Atara Neugroschl[1], Jeff Chieh Hsiao[2], Daniel Bachovchin[2,3]
[1]Stern College for Women, New York, NY
[2]Pharmacology Program of the Weill Cornell Graduate School of Medical Sciences, Memorial Sloan Kettering Cancer Center, New York, New York
[3]Chemical Biology Program, Memorial Sloan Kettering Cancer Center, New York, New York

When a danger-associated or pathogen-associated signal enters a cell, a pattern recognition receptor (PRR) identifies the threat and forms a protein complex known as an inflammasome. When activated, the inflammasome initiates the activation of caspase-1, which in turn cleaves the protein gasdermin D (GSDMD). Cleavage of GSDMD causes pyroptosis, a lytic form of programmed cell death categorized by the formation of pores in the cell membrane. Pyroptosis is an integral cellular pathway, as it clears the cell of danger while initiating an immune response. CARD8, a human inflammasome-forming protein, is known for undergoing an event termed auto-proteolysis, where the peptide chain is divided into two halves, the C-terminal (CT) and N terminal (NT), which remain noncovalently associated. When activated, the NT is degraded by a proteasome causing the CT to oligomerize and form an inflammasome complex. Currently, it is unknown which inflammasome is involved and how it degrades CARD8. Here, we demonstrate that CARD8's N-terminal intrinsically disordered region (IDR) is degraded by the 20S proteasome. While the N-terminal requires a disordered region, it is independent of sequence identity. Also, when a terminally disordered region is unavailable, an internal disordered sequence can be degraded, indicating an endoproteolytic machinery. Lastly, this process is independent of the ubiquitin-proteasome system (UPS). Overall, these data suggest that the 20S proteasome is sufficient to degrade CARD8's N-terminal IDR. Further study is needed to illuminate whether this process is sufficient or necessary to activate the CARD8 inflammasome and cause pyroptosis.

Regulation of Testicular Sertoli Cells by SUMOylation

By: Kayla Perlmutter[1], Tania Kiesel[1], Shanza Baseer Tariq[2], Manveet Nanda[2], Dr. Amitabha Sengupta[3], and Dr. Margarita Vigodner[3]
[1]Stern College for Women, Yeshiva University, New York, NY;
[2]Biotechnology Management and Entrepreneurship, Yeshiva University Katz School of Science and Health, New York, NY;
[3]Department of Biology, Stern College for Women, New, NY

Infertility affects 8-12% of the couples in the United States. Half of these cases can be attributed to the male partner, and 30-50% of these male infertility cases are idiopathic (e.g. occurring for an unknown reason). One major cause of male infertility is a failure of damage to spermatogenesis, the process in which male sperm are formed. New insights on regulation of spermatogenesis can shed light on specific cases of male infertility and possibly identify targets for male contraception.

Sperm formation is supported by testicular somatic cells, known as Sertoli cells. These cells are essential for spermatogenesis and produce important hormones and growth factors. Spermatogenesis and functions of Sertoli cells are supported by post-translational modifications which happen on cellular proteins after they have been synthesized.

The Vigodner lab focuses on a post-translational modification known as SUMOylation which is mediated by addition of small ubiquitin modifiers (SUMO) to the target proteins. One of the enzymes regulating SUMOylation in other cell types is a SUMO-ligating enzyme called KAP1 (KRAB-associated protein-1). This SUMO ligase was specifically chosen to study in Sertoli cells because it is a major regulator of SUMOylation in granulosa cells, which are the female equivalent of Sertoli cells. Additionally, KAP1 is highly expressed in testis and it colocalizes SUMO in Sertoli cells. The Vigodner lab hypothesized that KAP1 regulates SUMOylation in Sertoli cells. To support this hypothesis, we down-regulated KAP1 using small inhibitory RNAs (siRNAs) and then checked both the levels of SUMOylation and the viability of the cells.

Sertoli cell lines were transfected with KAP1 siRNAs followed by protein isolation. Then, the protein concentrations were tested using bi-

cinchoninic acid assay. Next, western blots were performed to check the amount of KAP-1 and SUMOylation As seen in Figure 1, in the presence of KAP-1 siRNsA, the protein expression of KAP-1 was significantly decreased as compared to the ones without the siRNAs. These results means that KAP-1 was significantly down-regulated.

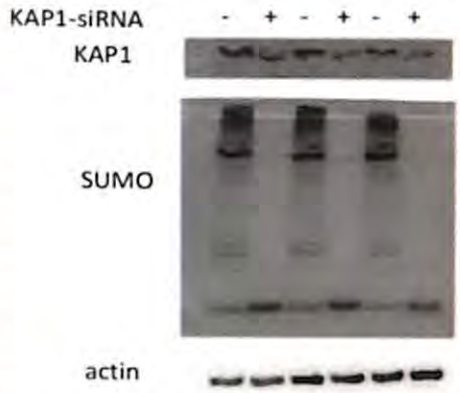

Figure 1: Western blot analysis of KAP1-siRNA, SUMO proteins and actin.

In the KAP-1 down-regulated samples, there was no SUMOylation of the high molecular weight proteins detected as compared to the control wells. At the bottom of the blot a level of free SUMO is seen, and the increased free SUMO level in the samples with the down-regulated KAP1 suggests that SUMO was not able to conjugate to the target proteins. Acting antibody was used on the same blot to confirm the level of equal loading of the sample. Therefore, KAP1 seems to play a major role as a SUMO ligase in Sertoli cells.

Following the down-regulation of KAP-1, the viability of the cells were tested using both water soluble tetrazolium salt (WST-1) assay, which is used to check cell viability, and Caspase-Glo Assay, which measures the level of apoptosis. In WST-1 assay, in Figure 2, a significant decrease in the cell viability is observed in the samples with KAP-1 siRNA.

Figure 2: Treatment of Mouse SE by KAP1 siRNA on WST-1 Assay

In case of Caspase-Glo assay, as seen in Figure 3, a significant increase in caspase level was observed for cells which were transfected with the high doses of the KAP-1 siRNA.

Figure 3: Treatment of mouse SE by KAP1 siRNA on Caspase-Glo Assay

In conclusion, the inhibition of KAP1 causes a down-regulation of SUMO conjugation to its target proteins. This means that it is very likely that KAP1 regulates SUMOylation in Sertoli cells and may act as a SUMO ligase. Also, the down-regulation of KAP1 affects the viability of Sertoli cells and initiates their apoptosis. This study provides a foundation for further studies in mice where SUMOylation and KAP1 activity will be inactivated in the Sertoli cells in mice. Also, testicular biopsies from infertile patients can be checked for the level of SUMOylation and screened for mutations in KAP1 SUMO ligase activity site.

Antigen Epitope Predictions by Computational Methods

By: Alexandra Roffe[1], Moshe Carroll[2], Avi Bodzin[2], Ethan Abizadeh[2], Shahar Lazarev[2], Evan Edelstein[2], Rajalakshmi Viswanathan[2]
[1]Stern College for Women, Yeshiva University, New York, NY 10016
[2]Department of Chemistry, Yeshiva College, Yeshiva University, New York, NY 10033

Interaction between antibodies and antigens in B-cells are crucial for our bodies to neutralize pathogenic molecules. Identifying antigen epitopes, amino acid residues on the antigen, are important to learn how they interact, to uncover the mechanisms in play, and to understand humoral immunity. Knowledge of antibody-antigen interactions is a key step in the process of developing drugs, therapies, and vaccines that utilize this interaction site. In the laboratory, determining the interface residues of an antigen can be difficult, expensive, and time consuming since it requires the crystallization of the antigen-antibody complex. With the availability of advanced computational methods and public repositories of structures of antigens, we can use computational tools to predict the epitopes of an antigen without needing to crystallize the complex.

To achieve the most accurate predictions, we used different computational approaches. There are template-based methods, intrinsic-based methods, and structure-based methods. Template-based methods identify an interface by mapping known information from a homologous complex structure. The drawback of template-based methods is that their effectiveness is contingent on the existence of homologues or structural neighbors that have a known complex structure. If no such structure exists, the method has a hard time predicting the protein's interface. The intrinsic based approaches train machine learning algorithms on a dataset of experimentally determined protein complex structures to create a model that relates sequential and structural features, like hydrophobicity, amino acid interface propensity, physicochemical properties, evolutionary conservation, solvent-accessible surface area, and geometric shape, with the likelihood that a residue is part of an interface. While intrinsic-based methods have been steadily enhanced over the past 20 years, their future improvement appears to be limited because further combination of existing features and classifiers has little impact on performance.

To overcome the limitations of intrinsic and template-based methods, we used meta-methods that integrate orthogonal predictors. Meta-PPISP is one such meta-method that combines the predictors cons-PPISP, Promate, and PINUP through linear regression analysis. Meta-PPISP combines complementary intrinsic-based approaches, but it does not consider inputs from template-based approaches. Furthermore, it employs linear regression analysis for method combination, instead of using a logistic regression analysis, which is more effective for discrete categorical data like a residue's interfacial score.

Our research group developed meta-DPI that integrates orthogonal approaches with the recently developed docking-based approach DockPred. Meta-DPI combines three orthogonal methods by logistic regression and random forest. We explore the suitability of Meta-DPI to make the epitope prediction of the antigens.

Our data set consists of 275 bound antigens and 195 unbound antigens. We tested the predictions on these antigens using four different methods, Meta-PPISP, ISPRED4, DockPred, and Vorffip. Each method's performance is shown in Table 1, Fig. 1, and Fig. 2. Each method was analyzed by comparing the F-scores and MCC values obtained by using a dynamic threshold for each query in the database. The dynamic threshold determines the number of top-ranking residues that will be considered as interface residues. The dynamic threshold was calculated for each query antigen using the following equation:

$$N = 6.1\ R0.3$$

where R is the number of surface exposed residues for each query protein, and N is the dynamic threshold. Using this threshold value, the elements of the Confusion matrix, True Positive (TP), True Negative (TN), False Positive (FP) and False Negative (FN) can all be determined. From there, the ROC and PR curves are made. If the area under the ROC curve is greater than 0.5, the method is better than randomly choosing the interfaces, which is the case. The area under the ROC curve of each method is shown in Table 1, and the curves are shown Figs. 1 and 2. The preliminary data are enclosed. We will work to combine these results to improve the predictive power of the algorithm.

Table 1: Statistical Analysis of Vorffip, ISPRED, and Meta-PPISP

	Bound:				Unbound:			
	F-score	MCC	Area - ROC	Area - PR	F-score	MCC	Area - ROC	Area - PR
Vorffip	0.243	0.165	0.714	0.161	0.173	0.103	0.662	0.101
ISPRED	0.256	0.180	0.685	0.159	0.194	0.126	0.657	0.115
Meta-PPISP	0.186	0.099	0.668	0.135	0.154	0.078	0.653	0.110

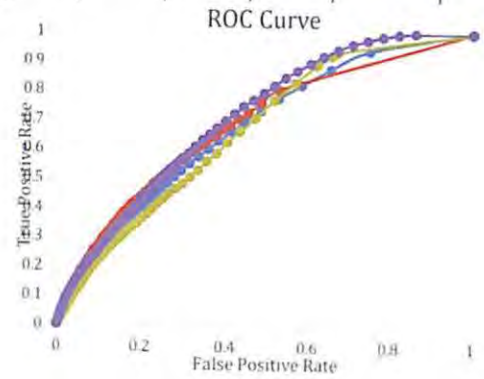

Figure 1: Comparison of ROC Curves for Four Independent Methods

Legend: Dockpred Ispred Meta-PPISP Vorffip

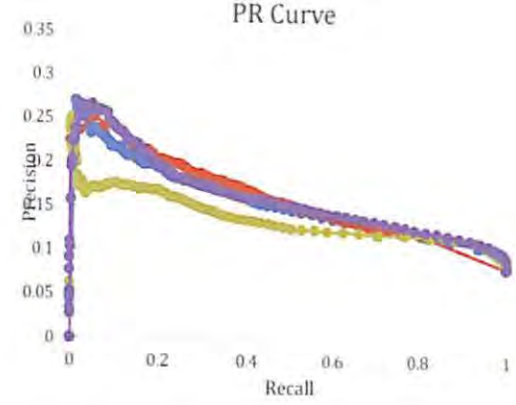

Figure 2: Comparison of PR Curves for Four Independent Methods

Legend: Dockpred Ispred Meta-PPISP Vorffip

Advances in triple-negative breast cancer research: Estrogen-related receptor alpha and its relationship to the mitogen-activated protein kinase pathway.

By: Adi Ronen[1], Dr. David Musheyev[1], Miriam Temmeh Lattin[1], Dr. Anya Alayev[1]
[1]Department of Biology, Stern College for Women, New York, NY

Breast cancer is the leading form of cancer found in women of all ages. Specifically, triple negative breast cancer (TNBC) accounts for about 10-15% of all cases and is associated with harsher tumors and a worse prognosis. TNBC is characterized as lacking expression of the three known molecular markers, namely estrogen receptors, progesterone receptors, and the HER2 protein. Development of treatments for TNBC proves to be more difficult than that of receptor positive breast cancers, due to the fact that the cancer cells do not express any known druggable targets. Interestingly, previous research on TNBCs has shown that though the tumors do not express any known molecular markers, they do have an upregulation of expression of estrogen related receptors alpha (ERRα), a transcription factor that plays an important role in energy metabolism and cell proliferation.

The work outlined in this abstract specifically explores the connection between the mitogen activated protein kinase (MAPK) pathway and ERRa. We identified nineteen unique phosphorylation targets, whose expression in MDA-MB-231, a TNBC cell line, was altered upon treatment with tamoxifen, an estrogen modulator, as well as with XCT-790, an inverse agonist of ERRα. One of the targets whose phosphorylation was upregulated by treatment with tamoxifen as well as XCT-790, was mitogen-activated protein kinase 1 (MAPK1), also known as ERK. This finding was validated by western blot analysis where we showed a statistically significant upregulation of ERK phosphorylation in TNBC cells treated with tamoxifen and/or XCT-790. Our data identified a connection between the MAPK signaling pathway and TNBC and showed an increase in the activation of ERK when the ERRα activity was inhibited. Furthermore, phosphorylation of RSK, a downstream target of ERK, also showed a parallel increase in phosphorylation, indicating that activation of the entire cascade was triggered by tamoxifen and XCT-790 treatments.

Overall, our results show that there is a relationship between ERRα and ERK and indicate that the MAPK signaling pathway should be considered for targeted treatment of TNBC.

The Enhancement of Cisplatin Treatment Of Resistant Cell Lines Via Glucose-Linked Gold Nanoparticles

Yitzhar Shalom[1]; Yoray Sharon[2]; Rachela Popovtzer[2]
[1]Stern College for Women of Yeshiva University, New York, NY;
[2]Department of Engineering of Bar Ilan University, Ramat Gan, Israel

The efficacy of the chemotherapy drug cisplatin is significantly undermined by the various mechanisms through which cancer cells develop resistance to the drug. One postulated mechanism of resistance is the exposure-induced reduction in the expression of CTR1, the surface receptor responsible for mediating the entry of the drug into the cell. Once in the cell, the drug is modified to a toxic form that attaches to adenine and guanine base pairs in DNA, introducing kinks in the secondary structure that impede replication. Hypothetically, therefore, cells that have adapted to downregulate CTR4 are less susceptible to the toxicity of the chemotherapy treatment.

Our project aims to bypass this mechanism of resistance by inducing entry through an alternate pathway. To do this, we synthesize gold-nanoparticles (GNPs) of 20 nm in diameter and conjugate them to cisplatin via a PEG 1,000 linker. GNPs have previously been demonstrated to be effective, nontoxic, nonimmunogenic vehicles for drug delivery1. We also attach glucose, the ligand of surface glucose transporters. The purpose is for the complex to enter the cell through a different route such that the CTR1 pathway is bypassed, and the treatment will still be detrimental to cells that have become naturally resistant.

To test this model, we generate resistant cells by continuously incubating strains of RENCA10 (renal cancer) and MB49 (bladder cancer) cells with increasing quantities of cisplatin, allowing recovery time in between subsequent drug treatments. Once the cells are determined to have achieved sufficient resistance, we apply our synthesized GNP-cisplatin-glucose complex and observe the resulting viability of the cells as they compare to cells treated directly with cisplatin and in comparison to non-resistant cells. Our hypothesis will be supported if the cells treated with the GNP-conjugated chemotherapy will result in greater cell death than non-conjugated cisplatin.

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Turner's Syndrome and Social Cognition

Alyssa Silvera[1], Dr. David Anaki[2]
[1]Stern College for Women, Yeshiva University New York
[2] Deparment of Cognition, Faculty of Brain Sciences, Bar Ilan University, Ramat Gan, Israel

Turner's syndrome (TS) is a chromosomal disorder that affects 1 out of 2,000 females characterized by a partially or completely absent X chromosome. While most people have 46 chromosomes, women with Turner's Syndrome usually have 45. Named after Henry Turner, an endocrinologist who discovered the syndrome in 1938, Turner's syndrome is associated with various physical abnormalities including short stature, webbed necks, cardiac and renal defects as well as ovarian dysfunction which leads to estrogen deficiency and infertility. In addition to physiological symptoms, Turner syndrome manifests itself through cognition as well. Individuals with Turner's syndrome demonstrate typical intelligence and verbal skills; however, they experience deficits in visuospatial and motor skills, executive functions, mathematics, and language. They also demonstrate poor psychosocial functioning which can be expressed through difficulties in forming and maintaining social relationships.

The present meta-analysis was conducted to assess the relationship between Turner's syndrome and social cognition. Social cognition can be described as the mental processes involved in perceiving, and attending to the other people in our social world. Individuals with Turner's syndrome have shown significant impairments in face perception as well as Theory of Mind (ToM), which is the ability to attribute mental states to the intentions of others' behaviors. These deficiencies are generally attributed to neuroanatomical anomalies in the hippocampal and amygdalar regions of the temporal lobe found in women diagnosed with Turner's syndrome.

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Exploring the Allosteric Effects of the SIRT6 Zinc Finger

Leeba Sullivan[1], Michael Akhavan[2], Professor Haim Cohen[3], Noga Touitou[3]
[1]Stern College, Yeshiva University, New York, NY;
[2]Yeshiva College, Yeshiva University, New York, NY;
[3]Department of Nanotechnology, Bar Ilan University, Ramat Gan, Israel

While many factors affect lifespan and healthspan, in recent years there has been a significant correlation between Sirtuin proteins and longevity, specifically Sirtuin 6. Sirtuin 6, or SIRT6, is an NAD+ dependent protein deacetylase. SIRT6 can act both as an ADP-ribosyl transferase and histone deacetylase, playing a critical role in various metabolic cycles including gluconeogenesis, DNA repair, and lipid metabolism.[1] The effects of overexpression of SIRT6 have been connected to extending healthy lifespan through maintaining and restoring energy homeostasis. Recent literature has shown that the overexpression of SIRT6 lengthened the lifespan of mice by 23%, while also maintaining their healthspan. Furthermore, these findings show that SIRT6 optimizes energy homeostasis in old age to delay frailty and preserve healthy aging.[2] As SIRT6 is a protein with a strong connection to a lengthened lifespan, its analysis of can contribute to further breakthroughs in the study of human aging.

In addition to the catalytic pocket, SIRT6, like many other proteins, contains a zinc finger, a structural motif on the Sirtuin. While little is currently known about the function of the zinc finger on SIRT6, it may play a crucial role in the proper folding of the despite its large distance from the catalytic site of SIRT6. Four cysteine residues of SIRT6 hold the zinc atom in place through various chemical interactions. Cystine has a strong affinity for the Zn2+, via the electrostatic interactions with the Zinc and the sulfur atom of the residue. Manipulations of this zinc finger on a molecular level can likely provide significant insight into the function of the zinc finger within the broader picture of the Sirtuin molecules. Mutagenesis was used to exchange the cysteine residue with an arginine residue to remove the interactions between the sulfur atom and the Zn2+ atom.[3] After which, a thermal analysis and activity assay were performed from the isolated mutant proteins.

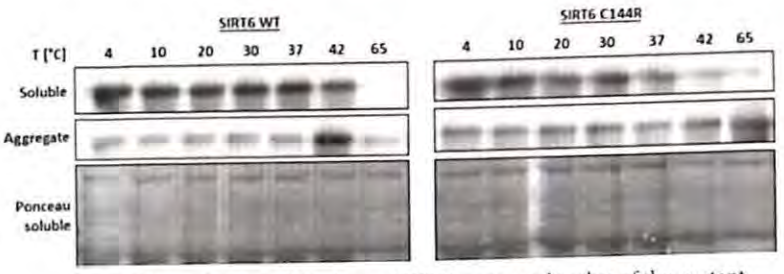

Figure 1 Thermal Analysis of SIRT6 compared to that of the mutant

The mutant protein of SIRT6 had a much more significant protein degradation than the wildtypes which can be based on the gradient depicted in Figure 1. In addition, the mutant samples appeared to have significantly more protein aggregate present than the control, indicating the role of the cysteine residue in the native protein.

The proteins were then used for an activity assay to determine whether the mutation connecting to the zinc finger affected the enzyme's catalytic activity despite its large distance from the active site. The assay was conducted at 30°C due to the stability of the mutant protein based on the previous thermal analysis. As SIRT6 acts as a histone deacetylase, the acetylation of H3 K9a was monitored in the presence of SIRT6 as well as NAD+. Compared to the wildtype, which had increasing deacetylation activity over time, the mutant protein appeared to have no catalytic activity at the site of the histone. Analysis of the blot using Image J displayed the normalized activity of the mutated SIRT6 was significantly depleted compared to that of the wildtype, as depicted in Figure 2.

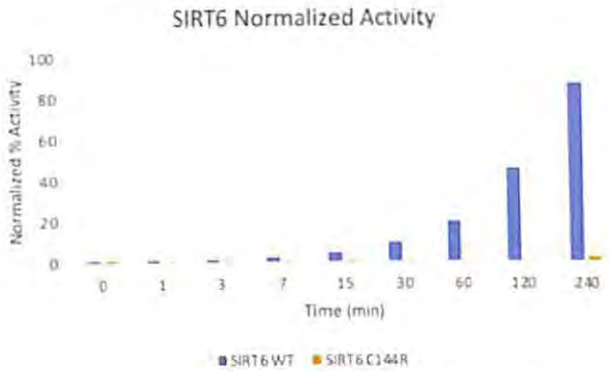

Figure 2 Normalized analysis of the SIRT6 wild type compared to the SIRT6 mutation using ImageJ

Further analysis of the other cysteine residues that interact with the zinc finger of SIRT6 would allow for further characterization of the protein. Additionally, mutations of the cysteine residue in the SIRT6 have been strongly correlated with thyroid cancer, providing additional interest in the protein mutation with potential for broader downstream cancer therapeutic effects.[4] The cysteine residue exchanged for tyrosine, a larger aromatic amino acid, has been found in various forms of thyroid cancer and may affect its native folding. The second mutation of interest was the removal of the thiol group from the cysteine residue, which is understood to have the strongest electrostatic interactions with the zinc molecule.[5] The exchange of the cysteine residue with an alanine residue via mutagenesis would allow for the determination if the sulfur molecules interacted with the zinc finger. Mutagenesis was successfully preformed, and further analysis is necessary to determine its overall allosteric effect on the protein.

While it is evident that the zinc finger has a significant effect on the catalysis effect on the SIRT6 molecule, there is still much about its folding and function that can be discovered. Through mutagenesis of the cystine residues that interact with the zinc finger, the zinc finger showed significant important in the catalytic and folding abilities of the protein. By analyzing Sirt6 and its structural motifs in action can be greater understood which is imperative information in the understanding of SIRT6 as well as its connection to both lifespan and healthspan. Furthermore, the as these mutations within SIRT6 have been strongly connected to cancer, further investigation into this mutation can provide insight to potential therapeutic avenues in the future.

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The Enhancement of Cisplatin Treatment Of Resistant Cell Lines Via Glucose-Linked Gold Nanoparticles

By: Yitzhar Shalom[1]; Yoray Sharon[2]; Rachela Popovtzer[3]
Stern College for Women of Yeshiva University, New York, NY[1];
Department of Engineering of Bar Ilan University, Ramat Gan, Israel[2], [3]

The efficacy of the chemotherapy drug cisplatin is significantly undermined by the various mechanisms through which cancer cells develop resistance to the drug. One postulated mechanism of resistance is the exposure-induced reduction in the expression of CTR1, the surface receptor responsible for mediating the entry of the drug into the cell. Once in the cell, the drug is modified to a toxic form that attaches to adenine and guanine base pairs in DNA, introducing kinks in the secondary structure that impede replication. Hypothetically, therefore, cells that have adapted to downregulate CTR4 are less susceptible to the toxicity of the chemotherapy treatment.

Our project aims to bypass this mechanism of resistance by inducing entry through an alternate pathway. To do this, we synthesize gold-nanoparticles (GNPs) of 20 nm in diameter and conjugate them to cisplatin via a PEG 1,000 linker. GNPs have previously been demonstrated to be effective, nontoxic, nonimmunogenic vehicles for drug delivery[1]. We also attach glucose, the ligand of surface glucose transporters. The purpose is for the complex to enter the cell through a different route such that the CTR1 pathway is bypassed, and the treatment will still be detrimental to cells that have become naturally resistant.

To test this model, we generate resistant cells by continuously incubating strains of RENCA10 (renal cancer) and MB49 (bladder cancer) cells with increasing quantities of cisplatin, allowing recovery time in between subsequent drug treatments. Once the cells are determined to have achieved sufficient resistance, we apply our synthesized GNP-cisplatin-glucose complex and observe the resulting viability of the cells as they compare to cells treated directly with cisplatin and in comparison to non-resistant cells. Our hypothesis will be supported if the cells treated with the GNP-conjugated chemotherapy will result in greater cell death than non-conjugated cisplatin.

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Developing homologous vector for RAG1 correction in CD34 cells

Tova Wax[1], Ayal Hendel[2] , Bryan Itkowitz[2], Dor Breier[2]
[1]Stern College for Women Yeshiva University New York, NY;
[2]Department of Biomedicine, Faculty of Life Sciences, Bar-Ilan University Ramat Gan, Israel

Severe Combined Immunodeficiency (SCID), is a group of disorders in which patients have severe defects in lymphocytes activity. These disorders are caused by mutations in one of multiple genes. One of those genes is *RAG1*. The *RAG1* gene encodes the RAG1 protein which is part of the RAG complex. The RAG complex is required for T and B cell maturation, as it is part of the recombination process required to maintain the diversity of their receptors. Due to their nonfunctional immune system, without treatment infants are not able to survive long. The conventional treatment for SCID is allogeneic bone marrow transplant which, while effective, holds severe risks, such as graft versus host disease (GvHD). Transplantation of hematopoietic stem and progenitor cells (HSPCs) from the patient himself that have been genetically corrected can be a possible alternative cure for this disorder.

Dr. Ayal Hendel's lab aims to find a solution to this disorder using a targeted genome editing approach, altering the DNA sequence of the HSPCs. This can be done using the revolutionary technology of CRISPR, Clustered Regularly Interspaced Short Palindromic Repeats, to attempt and fix the mutated gene. The CRISPR system is composed of a guide RNA (gRNA) and the Cas9 nuclease protein. The Cas9 is directed to a specific spot on the genome using a Watson Crick base pairing with the gRNA. The nuclease protein, Cas9, creates a double-stranded break (DSB) in the DNA at the target site. There are two pathways the cell can repair DSBs: the first way to repair the break is by nonhomologous end joining (NHEJ), fusing the ends of the cut sequence together, which usually creates mutations in the form of insertions and deletions (INDELs) at the location of the DSB. The other way to repair the genome is by Homologous recombination (HR), which functions as a cut and paste tool, essentially replacing the cut sequence with a normal sequence copied from a matching donor template. HR may be used to cure SCID along with other disorders, by introducing a correct copy of the gene into the DSB by using a corrective donor template.

My project in Dr. Hendel's lab was to create a new donor plasmid that could be used as a template to correct the defective RAG1 gene in HSPCs by using the HR mechanism.

Once the plasmid was designed, primers to amplify the segments required for the plasmid were created. The primers were used in a Polymerase Chain Reaction (PCR) to amplify the required segments. To ensure the PCR worked as planned, calibrations were done to determine temperatures and conditions for the PCR. Once the required segments were amplified, they were tested by running them on an agarose gel. Once the PCR product was determined to be correct it was cut from the gel and purified. A Gibson reaction was then performed, which was used to assemble the DNA in the correct order and insert it into the proper vector. The reaction was followed by transforming bacteria which were seeded on plates containing ampicillin overnight. Once the bacteria formed colonies on the plate, a total of six colonies were picked and placed in LB to continue to grow. The bacteria in LB were placed in a shaker overnight to ensure proper growth and development and then extracted using GeneJET Plasmid Miniprep Kit (Thermo Fisher Scientific, USA). Throughout the experiment, the NanoDrop machine was used to measure the quantity and purity of both the PCR segments and the final plasmids. Following plasmid harvesting, a restriction testing of the plasmids was executed to determine if the plasmids were indeed correct. The plasmids were then run on a gel and compared to a computer simulation to further confirm that the plasmid is correct. Once the plasmid was found to be correct, it was sent for sequencing to verify the product. If all went well the plasmid would then be of use to Dr. Hendel's lab in their research to correct the RAG1 gene and hopefully cure the SCID disorder.