

# Opportunities for Research & Exploration at Bergen County Academies



## **The BCA Research & Exploration Mission**

The mission of BCA Research & Exploration is to expose students to scientific inquiry, research and instrumentation, and to provide transferable, firsthand experiences with the techniques, practices and perspectives of professionals. By expanding the capabilities and context of secondary education, we believe that students will be better equipped for, and more likely to pursue leadership positions in research and global-scale problem solving.

## **Program** – Creative Writing Research

**Teacher** – Mr. Weems (*ricwee@bergen.org*)

**Open to Grade Level** – 11th, 12th

**Pre-Requisite** – Vested interest in writing

**Program description/Objective** – Students in this program work with faculty and utilize peer feedback to develop individual creative writing projects. After the writing and editing process, students are encouraged to submit to various writing competitions.

**Room** – 44

**Competitions** – Students submit to various competitions within their writing genre. Student submissions in poetry, fiction, personal essay and playwriting as well as various other forms are encouraged.

**Outcome** – Students in this program have won Gold and Silver medals from the Scholastic Art and Writing Awards, the Patricia Grodd High School Poetry contest sponsored by Kenyon College, and NJ Governor's Awards in Arts Education. Students have also been finalists for the National Student Poets Program and attended the New England Young Writers Conference at Bread Loaf.



## **Program** – Concert Choir

**Teacher** – Mr. Spinelli (*louspi@bergen.org*)

**Open to Grade Level** – 9th, 10th, 11th, 12th

**Pre-Requisite** – Must be able to match pitches through auditions

**Program description/Objective** – Open to all grades, concert choir is the largest elective on campus with over 150 members. Our choir performs at concerts, festivals and competitions, as well as twice a year at BCA. Music styles range from classical repertoire to jazz and even rock. The atmosphere is both serious and friendly; it is an excellent opportunity to make friends and to enhance your musicianship.

**Room** – 225

**Competitions** – Students typically participate in one competition annually, either through Performing Arts Consultants or Worldstrides Heritage, and compete against 1 - 5 other choirs in our division. Every other year the choir makes a trip to either Washington, DC, or to Boston. In alternate years, the competition is at a local high school, and the choir usually goes into NYC to attend a Broadway show, then an awards banquet and DJ dance.

**Outcome** – Our choirs have consistently received gold ratings, usually with top honors.

## **Program** – BCA Theatre Productions

**Teachers** – Mr. Kaplan (*stekap@bergen.org*), Ms. Pero (*vicper@bergen.org*)

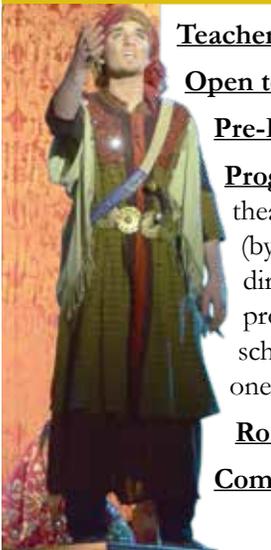
**Open to Grade Level** – 9th, 10th, 11th, 12th

**Pre-Requisite** – None

**Program description/Objective** – Each year the BCA Theatre department produces three fully mounted theatrical productions including one musical and two non-musicals. Students may participate as performers (by audition) as stage managers, assistant directors, house managers, or technicians by speaking with the director of the particular production. Students work together with theatrical professionals to rehearse and produce a full-length play or musical. This elective course meets four days per week plus 2 hours after school each day. Participation is recommended to the student who is ready for a major commitment, for one trimester, to the theatrical process.

**Room** – Auditorium Stage

**Competitions** – Montclair University Theatre Night Awards, New York Metro High School Theatre Awards



## **Program** – Mechatronics Research Lab

**Teacher** – Mr. Nodarse (*carnod@bergen.org*)

**Open to Grade Level** – 10th, 11th, 12th

**Pre-Requisite** – Students interested in the Mechatronics Research Lab need Mechatronics Research Lab Exploration as an elective; they can also take Introduction to Robotics for additional insight into electronics circuit, mechanical design and programming.

**Program description/Objective** – The Mechatronics Research Laboratory is a laboratory within Bergen County Academies. In this laboratory, students will conduct research and develop innovations in the areas of digital electronics, robotics and programming. Some projects include the development of autonomous robotics, electronic devices, and control system interfaces. Students will be expected to have a working prototype, research report and enter a competition before the end of the course. The student is required to conduct research for 4 trimesters in a row (1 year and 1 trimester). The first three trimesters are typically spent researching and prototyping, and the fourth trimester is intended for the finalization of the project. Students should retain a modicum of flexibility within their schedules to successfully complete the research program.

**Room** – 146

**Competitions** – New Jersey Regional Science Fair, New Jersey Academy of Science, Source American-Design Challenge, Google Science Fair

## **Program** – Electrical Engineering Research

**Teacher** – Mr. Liva (*micliv@bergen.org*)

**Open to Grade Level** – 10th, 11th, 12th

**Pre-Requisite** – Pre Engineering Research Elective

**Program description/Objective** – The program is designed to allow students interested in Electrical Engineering to work on a design project. Students will advance their skills in areas like design and fabrication, sensor interface, data acquisition and control.

**Room** – 168

**Competitions** – Participating in a competition is not a requirement. In the past students have worked with other organizations such as the Lemelson Foundation, Kokutaiji High School and NASA on the ICED challenge.

**Outcome** – Students have secured internships at Recon Industrial Controls Corporation, Columbia University and other organizations.

## **Program** – Engineering Research

**Teacher** – Mr. Barbetta (*josbar@bergen.org*)

**Open to Grade Level** – 10th, 11th, 12th

**Pre-Requisite** – None

**Program description/Objective** – The Engineering Research elective provides individually scheduled work periods in the BCA Makerspace for students interested in engineering research projects and competitions. Past projects have included the creation of student inventions and innovations, civil and architectural designs and the participation in engineering/science fair competitions. Documentation requirements include a lab notebook and final report or portfolio. The course ends with an oral presentation and prototype demonstration. An approved Project Development Contract is required for registration. Research can be taken 1-3 trimesters per year.

**Room** – 166

**Competitions** – Competitions are not a requirement, but they are encouraged. New competitions are added each year. Some past events include: Panasonic Creative Design Challenge, Team America Rocketry Challenge, Extreme Redesign Competition, Skills USA – Engineering, Toshiba Exploravision, West Point Bridge Building, US First, BattleBots, NJRSC, and more.

**Outcome** – Students generally intern at the leading engineering firms in our area. Some examples include: United Water (Suez Environment), Becton Dickinson, Mercedes-Benz USA, Axis Architectural Studio, Recon Industrial Controls Corporation, Kreisler Manufacturing Corporation, Vision Research, Inc.



## **Program** – Agriscience Research

**Teacher** – Ms. Kennedy ([claken@bergen.org](mailto:claken@bergen.org))

**Open to Grade Level** – 9th, 10th, 11th, 12th

**Pre-Requisite** – Introduction to Agricultural Science

**Program description/Objective** – Independent/small group research on projects centered on the science of agriculture (food, fiber, fuels, sustainability). These projects may be controlled experiments, sociological investigations, financial/entrepreneurial research, and/or engineering-based invention.

**Room** – Greenhouse

**Competitions** – Participation in the BCA FFA chapter and attendance at FFA events and competitions are an integral part of the culmination of the research project. The Agriscience Fair, conducted by the State FFA in late April each year, is a mandatory function as is membership in the BCA FFA.

**Comments** – There is a time commitment for the students of 6 mods per week that does not include the required prerequisite course. Research may continue for subsequent years.



## **Program** – Stem Cell Research

**Teacher** – Dr. Smith ([erismi@bergen.org](mailto:erismi@bergen.org))

**Open to Grade Level** – 9th, 10th, 11th, 12th

**Pre-Requisite** – Research Applications in Molecular Biology and Genetics (ResMol)

**Program description/Objective** – The laboratory houses facilities and instrumentation not available at any other high school. Students collaborate with faculty on the selection of their individual research projects based on some aspect of biology the student finds especially interesting. Current projects include analyses of stem cells and their derivatives, the molecular and genetic basis of cancer, Alzheimer's disease, obesity, arthritis and the aging process among others, and the impact of various potential therapies on them. The common thread behind all the projects is the educational value implicit in pursuing a personal goal for which there is “no answer in the back of the book.” All students learn how to handle experimental data, and statistically determine whether their results are significant or not. The program has recently been further improved by collaboration with the surgical lab at Englewood Hospital. Fee required!

**Room** – 213

**Competitions** – There are a large number of competitions in which our students are able to participate. The local competitions, open to all grades, include the NJRSF, NJAS, YSAP, YES and numerous others. The highest achievers in the Siemens and Intel competitions have all participated in the summer bio research program. Students have published papers in scientific journals and have applied for patents based on their research in this lab.

**Outcome** – Students have gone to internships at Englewood Hospital, Valley Hospital, Hackensack Medical Center, Bergen County Medical Examiner, Columbia Presbyterian Medical Center, Weill Cornell Medical Center, Memorial Sloan Kettering Cancer Center, and many others.

**Comments** – We welcome the opportunity to show the labs and discuss the benefits and issues (especially the time commitment) with students and parents. Our goals are to educate students in the rigors of scientific thinking and problem solving, to move our students into positions of prominence in science fairs and scholarship competitions, and to publish formal papers in the scientific literature. The potential impact of such activities on the college entrance process is self-evident. There are a large number of competitions in which our students are able to participate.



## **Program** – Laboratory of Cell Biology

**Teacher** – Dr. Sabio ([gorsab@bergen.org](mailto:gorsab@bergen.org))

**Open to Grade Level** – 9th, 10th, 11th, 12th

**Pre-Requisite** – Research in Cell Biology

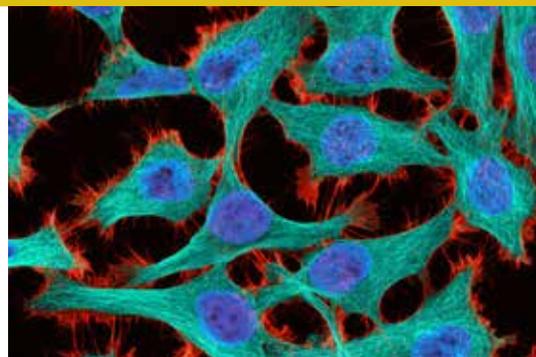
**Program description/Objective** – A research experience in the Laboratory of Cell Biology, enables students to carry out investigations in areas of their own personal interest. Projects involve the utilization of cellular and molecular biology techniques to address a wide variety of questions in the biological sciences. Curricular goals include educating students in the rigors of scientific thinking

and problem solving. Students in the laboratory have access to the latest scientific equipment to pursue their studies. Fee required!

**Room** – 224

**Competitions** – Numerous accolades have been awarded in venues such as the North Jersey Regional Science Fair, the International Science and Engineering Fair, Siemens Competition, INTEL Science Talent Search, National Academy for the Advancement of Sciences, National Junior Science and Humanities Symposium, BioGENEius, White House Science Fair, Young Science Achievers Program, Google Science Fair, and others. Students have also published their research in peer-reviewed journals and have participated in the patent process. A research paper submission to a major competition is required of all students who are seniors in the Bioresearch program.

**Outcome** – Students from the Cell Biology Laboratory have been invited to intern at Columbia University's Center for Craniofacial Regeneration as well as other labs at Columbia, Memorial Sloan Kettering, Hackensack Hospital, Englewood Hospital, and labs with prerequisite technical skills in the area of cell and molecular biology.



## **Program** – Physics/Optics Research

**Teacher** – Dr. Dogru ([ozgdog@bergen.org](mailto:ozgdog@bergen.org))

**Open to Grade Level** – 9th, 10th, 11th, 12th

**Pre-Requisite** – Topics in Science and Research or Quantum Physics Elective

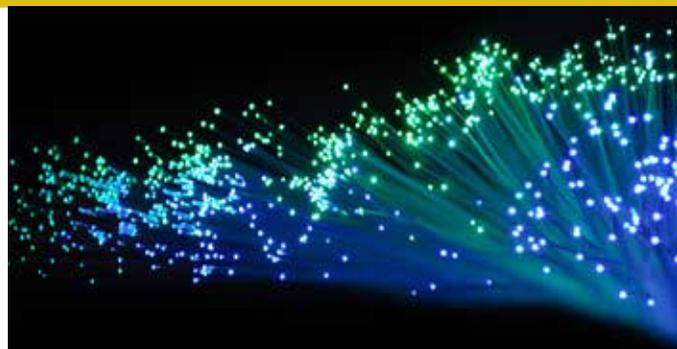
**Program description/Objective** – The Physics research program provides opportunities for students to work on various projects and gain experimental and analytical skills to excel in Physics. Students can work on advanced projects including Interferometry, Holography and Fiber Optics. They also have an

opportunity to be involved in building a spectroscopy setup, which aims at measuring minuscule amounts of trace gases using laser spectroscopy. Students may work on any project they select under the guidance of Dr. Dogru. Depending on the particular project, the nature of the work involves reading scientific articles, setting up experiments, data acquisition, data analysis, and software programming. Students willing to pursue a theoretical project in Physics are also encouraged to contact Dr. Dogru for possible collaborations with outside institutions.

**Room** – 19

**Competitions** – Students are not required, but encouraged to participate in competitions depending on the nature of the projects. Possible competitions include American Association of Physics Teachers (AAPT) Conference, Exploravision, North Jersey Regional Science Fair, Junior Science and Humanities Symposium (JSHS) at Rutgers.

**Outcome** – Students are expected to present the results of their work and experience in a written scientific format. Internship opportunities at universities are possible for competitive applicants.



## **Program** – Nano-Structural Imaging Lab Biological Research

**Teacher** – Mrs. Waldron ([alywal@bergen.org](mailto:alywal@bergen.org))

**Open to Grade Level** – 9th, 10th, 11th, 12th

**Pre-Requisite** – Introduction to Microscopy

**Program description/Objective** – The mission of Nano-Structural Imaging Lab Biological Research is to introduce students to scientific inquiry, through research and instrumentation, and to provide transferable, hands-on experiences with the techniques, practices and perspectives of professional scientists with an emphasis on microscopy as an analytical technique, especially electron microscopy. Students are eligible to participate in this program after completing one of the pre-requisite courses. Next, the student will develop a novel research project based on their own interests and current scientific literature, in cell biology, molecular biology, structural biology, biomedical research, or related fields. They will then learn the tools and techniques to carry out experiments on a topic of their choosing, acquire and analyze data, and present their results in either written or oral form.

**Rooms** – 176 / 178

**Competitions** – North Jersey Regional Science Fair (required), Intel International Science & Engineering Fair, Young Science Achievers Program, Intel Science Talent Search (required), Siemens Competition in Math, Science & Technology (required), Google Science Fair, New Jersey Academy of Science Meeting, Monmouth Junior Science Symposium, and/or Publication in Microscopy & Microanalysis

**Outcome** – Students from this lab have produced images that have been described as “textbook quality” by professionals in the field. This program provides a comprehensive experience of being a professional scientist. These students are well suited to pursue careers in bioimaging, histology, pathology, and other clinical research options.

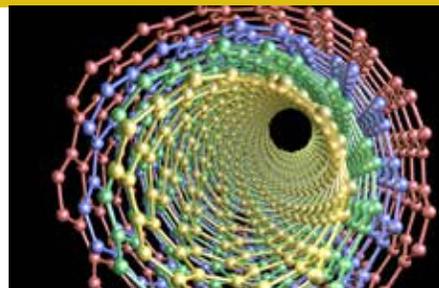
## **Program** – Chemistry/Nanotechnology

**Teacher** – Dr. Kim ([deokim@bergen.org](mailto:deokim@bergen.org))

**Open to Grade Level** – 10th, 11th, 12th

**Pre-Requisite** – Foundations of Nanotechnology Elective

**Program description/Objective** – Chemistry/Nanotechnology research with Dr. Kim is an elective, project-based program for independent student research in the emerging field of chemistry and nanotechnology. First, students will be encouraged to independently utilize a range of scientific communication technologies such as scientific news websites, scientific journals, and other material in order to investigate real world problems and eventually develop realistic chemistry/nanotechnology related solutions based on their understanding of scientific methods. In the second phase, students will learn how to apply their scientific knowledge, assess societal impact and estimate the budget while developing their own experimental designs and procedures for the applications of their projects. Based on the designs of experiments, students will perform their experiments under the supervision of Dr. Kim and collect their own data. Students will also learn technical skills of operating various state-of-the-art scientific equipment available in the field of chemistry and nanotechnology. The final stage of the chemistry/nanotechnology research will be dedicated to nurture critical thinking abilities of student researchers by interpreting research data as the result of their project investigation and to polish communication skills to summarize and deliver their results to their peers by participating in various form of competitions.



**Room** – 244

**Competitions** – Young Science Achievers Program, Northern Jersey Regional Science Fair (NJRSF), Junior Science and Humanities Symposium (JSHS) at Rutgers, New Jersey Academy of Science (NJAS) Fair, Google Science Fair, Materials Research Society - Fall Meeting Poster Presentation, Siemens Competition (requirement in senior year), Intel Science Talent Search (requirement in senior year)

**Outcome** – There are many interesting internship opportunities for chem/nano students, including but not limited to: BASF (paid summer internship after graduation), Becton Dickinson, Brookhaven National Lab, Columbia University, EDAX, Lamont-Doherty Earth Observatory, New Jersey Institute of Technology – Polymer Processing Institute, Reckitt Benckiser, Sun Chemical Corporation, Stepan Company, and Stevens Institute of Technology.

## Program – Math Research

**Teacher** – Dr. Penev ([krapen@bergen.org](mailto:krapen@bergen.org))

**Open to Grade Level** – 9th, 10th, 11th, 12th

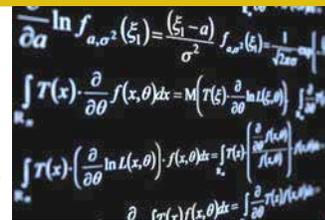
**Pre-Requisite** – None

**Program description/Objective** – The Math research program is aimed at preparing students for contests based on math research such as Siemens and Intel talent search. The students write papers in Combinatorics, Number Theory, Geometry, etc. Every year our students win math grants through YSAP. They also take part in NJRSF, ISEF, AMC 10, AMC 12, AIME, USA Math Olympiad and the International Math Olympiad. We offer electives, projects, clubs and individual work with students involved in this program.

**Room** – 268

**Competitions** – Students are required to participate in one or more of the following competitions: Intel, Siemens, NJRSF, YSAP, AMC 10, AMC 12, AIME, USA Math Olympiad and the International Math Olympiad

**Comments** – Students in previous years have won the USA Math Olympiad and the International Math Olympiad in Thailand, and have achieved high placement at the Siemens competition in Math, Science and Technology.



## Program – Bloomberg Markets Concepts Certification

**Teacher** – Mr. Fogg ([frefog@bergen.org](mailto:frefog@bergen.org))

**Open to Grade Level** – 10th, 11th, 12th

**Pre-Requisite** – Students interested in finance **and** one of the following classes:

- Advanced Business & Financial Topics
- AP or IB Economics
- Markets & Trading elective



**Program description/Objective** – Bloomberg Markets Concepts (BMC) is an 8-hour self-study series of e-learning tutorials that you can access from any device and view anytime. BMC consists of four modules covering the essentials of financial markets: Economics, Currencies, Bonds/ interest rates and Equities. This is an opportunity for students to learn how the theories we discuss in class are applied in the real world and to get practical, hands-on experience using the Bloomberg terminal. The on-line version of BMC can be accessed at <https://about.bloomberginstitute.com/students/bloomberg-market-concepts/>. There is a \$149 student fee payable to Bloomberg for students to register.

**Room** – Financial Markets Lab (180) and self-study

**Competitions** – Competition is not a requirement, however Bloomberg functionality is used extensively by students preparing for the Federal Reserve Challenge, Economics research or students engaged in Extended Essays in finance or economics. It is also used in advanced coursework in financial markets, economics and corporate finance.

**Outcome** – BMC is widely accepted and respected as a benchmark for student and professional achievement in the field of finance. It is typically a required component of college-level courses in economics and finance, and proficiency with Bloomberg functionality is an important skill that can help students pursue internships and careers in the field of finance.

**Our research students have taken top honors in many prestigious competitions. Here are just a few...**



For more information, please visit: <http://research.bergen.org/index.php/research-home>

## **Program – Applied Web Development**

**Teacher** – Mr. Respass ([bryres@bergen.org](mailto:bryres@bergen.org))

**Open to Grade Level** – 10th, 11th, 12th

**Pre-Requisite** – Interested students must complete two electives: Structured Query Language; Intro to Web Development

**Program description/Objective** – In this program, students create web applications for the school to use in managing its processes and events (e.g. Career Day, Standardized Testing, Field Trip Management, among others). Students participate in the entire project cycle including requirements gathering, development, testing, review with business owners, deployment, and support.

**Rooms** – 138



## **Program – BCA Active Floor**

**Teacher** – Mr. Respass ([bryres@bergen.org](mailto:bryres@bergen.org))

**Open to Grade Level** – 9th, 10th, 11th, 12th

**Pre-Requisite** – Students must either be enrolled in “Intro to Computer Science” or have completed “Intermediate Java”. Interested students must participate in an orientation session with Mr. Respass (offered monthly). Following the session, students may work with the Active Floor during their free mods. Students demonstrating growing proficiency and sustained interest with the Floor can then propose a project to pursue more formally.

**Program description/Objective** – Students create games and interactive learning experiences that run on BCA’s interactive Active Floor! Bring ideas of what you wish to build.

**Room** – 138

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