Eighteen students (12 individual projects and 3 team projects) were selected from NYCSEF to represent NYC at the 2008 Intel ISEF in Atlanta, GA from May 11-16, 2008. The Intel ISEF, the world's largest international pre-college science competition, annually provides a forum for more than 1,500 high school students (grades 9-12) from over 40 countries to showcase their independent research. The Intel ISEF unites these top young scientific minds through participation in a series of activities celebrating their accomplishments and by providing an opportunity to compete for nearly $4 million in prizes and scholarships. Below is a list of the NYC representatives.

(Back row-left to right: Elie Bochner, Timothy Chang, Nischay Kumar. Middle Row-left to right: Erin Zeqja, Julian Rivera, Pukar Hamal, Tinya Cheng, William Kalb. Front Row-left to right: Eleanor Riely, Katherine Cagen, Katherine Banks, Na Xue, Shai Chester, Artem Serganov, Elizabeth Whitman, Christina Xiong, Tabbasum Rahman. Seated: Billy Huang)

ISEF FINALISTS INDIVIDUAL PROJECTS

Katherine Banks (Stuyvesant HS) – Senior
ISEF Awards: United States Army Award; United Technologies Corporation Award
Project Title: The Nonagon Anomaly
Project Summary: I studied convex polygons whose vertices are points on the "integer lattice"—the set of points with integer coordinates. They're easy to visualize as the intersections of a regular grid of streets and avenues. Specifically, I gave a new proof that a 9-sided one of these polygons can't have exactly 8 or 9 lattice points inside.

Katherine Cagen (Horace Mann School) – Senior
ISEF Awards: Category Grand Award: Earth and Planetary Sciences (2nd Award); Geological Society of America
Project Title: Evidence for a Tsunami Generated by an Impact Event in the New York Metropolitan Area Approximately 2300 Years Ago
Project Summary: Recently, evidence has been found suggesting that there was a tsunami in the New York City area approximately 2300 years ago. However, no source for the tsunami was identified. My research attempts to prove that the tsunami was generated by the impact of a meteorite or comet into the Atlantic Ocean south of Long Island.
Tim Chang (Stuyvesant HS) – Senior

ISEF Awards: Category Grand Award: Environmental Management (Best in Category)
Project Title: Kinetics of Bioremediation and Electricity Production in a Novel Microbial Fuel Cell

Project Summary: Microbial fuel cells are a source of alternative energy that operates by breaking down organic pollutants. Wastewater in the US contains on average about $2 billion of energy stored in its chemical bonds. Currently, we are putting $25 billion a year into treating this water, when we can be extracting energy from our waste. This project worked on extracting this energy.

Pukar Hamal (Forest Hills HS) – Junior

ISEF Awards: Category Grand Award: Animal Sciences (2nd Award); University of the Sciences in Philadelphia (Tuition Scholarship)
Project Title: Refining the Establishment of Left/Right Asymmetry in the Nervous System of Caenorhabditis elegans

Project Summary: Left/Right asymmetry has been quite an age old topic in science; much research has been done on different animal species to understand this asymmetric phenomenon and its long-term developmental roles. People have always wondered why our brain being a bilaterally symmetric organ has such asymmetric properties in terms of functionality and on a molecular level. This study endeavored to refine the established understanding of left/right asymmetry in the nervous system exemplified by the two ASEL (left) and ASER (right) gustatory neurons of Caenorhabditis elegans.

Billy Huang (Bronx HS of Science) – Senior

ISEF Awards: Category Grand Award: Medicine and Health (4th Award)
Project Title: Development of Multimodal Confocal Microscopy to Enable Rapid Assessment of Skin Cancer Excisions during Mohs Micrographic Surgery

Project Summary: The precise removal of non-melanoma skin cancers is vital for skin cancer treatment. This research uses lasers to scan and detect skin cancers. The current method of detecting skin cancer is through the use of surgical excisions (i.e. biopsies). The method described in this project offers a novel solution to this by using lasers to do the same job, but more efficiently in a clinical (surgical) setting during Mohs Micrographic Surgery. Results indicate that multimodal imaging offers similar levels of contrast to that of frozen histopathology while cutting down the examination time to 7 minutes, which reduces the overall surgical procedure.

William Kalb (Horace Mann School) – Senior

ISEF Awards: Category Grand Award: Engineering Materials and Bioengineering (2nd Award)
Project Title: Evaluation and Measurement of the Frictional Properties of Graphene by Atomic Force Microscopy

Project Summary: Graphene is a newly discovered form of carbon with some very interesting and unique properties. It is formed out of two dimensional sheets of carbon that are only a single atom thick. Graphene has unusual electrical properties, is very flexible, almost as strong as diamond, and almost frictionless. These properties mean that it has great potential for applications in micromachenery and electrical systems.

Tabbasum Rahman (Townsend Harris HS) – Senior

Project Title: Drosophila Models of LEOPARD Syndrome

Project Summary: LEOPARD syndrome (LS) is a rare autosomal dominant genetic disorder characterized by lentigines, electrocardiographic abnormalities, ocular hypertelorism, pulmonary stenosis, abnormal genetilia, retardation of growth and deafness. Since LEOPARD syndrome increases the risk of cancers like leukemia and neuroblastoma, studying it would get us more information on how the cancer works by understanding how opposing functions of the same gene could lead to similar clinical features in an in vivo model using Drosophila melanogaster.

NYCSEF/ISEF 2008 Finalists  2
Eleanor Reilly (St. Francis Prep HS) – Senior
Project Title: The Effect of Amyloid-beta Accumulation on Neuronal Receptors in the Brain
Project Summary: My project examined the pathogenesis of Alzheimer's disease and the means by which amyloid-beta, a toxic plaque, accumulates and interferes with synaptic function. I found that thinking can recover memory, even when amyloid-beta is present. In addition, my research uncovered amyloid-beta presence in the late endosomal/lysosomal system, suggesting it interferes with the degradative pathway and thereby interrupts proper synaptic transmission.

Julian Rivera (St. Francis Prep HS) – Senior
Project Title: The Age Determination of the Milky Way Galaxy as a Function of the Heat Distribution of Cool Degenerate White Dwarfs
Project Summary: White dwarfs are the final stage of stellar evolution for intermediate-massed main sequence stars. Once a white dwarf is formed, it immediately begins cooling as a result of it lacking the ability to perform the nuclear processes to produce heat due to insufficient mass. It has been proposed that the age of white dwarfs could effectively be used to obtain the age of the galaxy itself. Since the evolution of a white dwarf is dominated by its cooling the main focus of this study is the temperature of the white dwarf. It was discovered that white dwarfs do possess the ability to differentiate among different star formation rate theories rather accurately in general settings.

Artem Serganov (Bronx HS of Science) – Senior
Project Title: The Crystallization of Riboswitches: Potential Targets for Antibiotics
Project Summary: Alarming expansion of antibiotic resistance necessitates the development of novel classes of antibiotics specific for new sites. Riboswitches, evolutionary conserved RNA elements recently found in mRNAs, control expression of genes essential for microbial viability and, therefore, represent potential targets for novel types of antibiotics. This project involved gathering data about the 3D structure of a riboswitch bound to a small molecule in the hopes of finding potentially useful details that may help researchers develop antibiotics that target riboswitches and kill microbes.

Na Xue (Midwood HS) – Senior
ISEF Awards: Category Grand Award: Microbiology (4th Award)
Project Title: Rational Design of Novel Anti-HIV Peptides Containing Multi-Functional Domains
Project Summary: I designed peptides and compared their inhibitory activity on HIV-1-mediated cell-cell fusion and their biophysical properties. These results suggest that although the HR sequences are essential for the basic structure of the antiviral peptides, the functional domains are also required for these peptides to specially interact with the target sites in order to exert their maximum anti-HIV activity. Therefore, this study provides important information for better understanding the mechanisms of action of the peptidic HIV fusion inhibitors and rational design of the next generation of anti-HIV drugs targeting gp41.

Erin Zeqja (Townsend Harris HS) – Senior
ISEF Awards: Category Grand Award: Physics and Astronomy (3rd Award); Patent and Trademark Office Society Award; Vacuum Technology Division of the American Vacuum Society Award
Project Title: Detection of Biomolecules via Coupling of Type-I and Type-II Quantum Dots
Project Summary: This project proposes a novel and unique method for environmental sensors based on the optical properties of colloidal quantum dots (QDs). These proposed sensors will establish improved diagnostic methods and sampling strategies in order to identify pathogens more rapidly and precisely. This is crucial in the protection of our public and soldiers from a chemical/biological attack, viruses, or hazardous leakage.

ISEF Finalists Team Projects
Elie Bochner and Shai Chester (Yeshiva University HS for Boys) – Seniors
ISEF Awards: Category Grand Award: Engineering Materials and Bioengineering Team Project (Best in Category); Sigma Xi: The Scientific Research Society Award
Project Title: Improving the Feasibility of Avalanche Gain X-Ray Detectors

ISEF FINALISTS TEAM PROJECTS
Elie Bochner and Shai Chester (Yeshiva University HS for Boys) – Seniors
ISEF Awards: Category Grand Award: Engineering Materials and Bioengineering Team Project (Best in Category); Sigma Xi: The Scientific Research Society Award
Project Title: Improving the Feasibility of Avalanche Gain X-Ray Detectors
**Project Summary:** Current x-ray detectors expose patients to dangerously high levels of radiation. Our project improved the development of a novel x-ray detector for digital radiology that can obtain high-quality images under significantly lower radiation dosages than current detectors. Additionally, this single detector can be used for every radiographic procedure, so it is more economical than the current technology.

_Tinya Cheng and Nischay Kumar_ (Townsend Harris HS) – Seniors

**ISEF Awards:** Category Grand Award: Physics and Astronomy Team Project (2nd Award); SPIE – The International Society for Optical Engineering Award

**Project Title:** Development of Three Dimensional Photonic Integrated Circuits through a Bottom-Up Approach

**Project Summary:** Our research objective was to establish a cost and time effective scheme that would create circuits whose processing functions rely on the movement of photons. We have tried various fabrication techniques and used several innovative materials to create our circuits. Although, the circuit hasn't been optimized for our application, the novel methodology we have created can serve as a platform to make these circuits commercially available for researchers and device applications.

_Elizabeth Whitman and Christina Xiong_ (Benjamin Cardozo HS) – Seniors

**ISEF Awards:** Category Grand Award: Plant Sciences Team Project (3rd Award)

**Project Title:** The Role of Calcium-Sodium Interactions in Promoting Salt-Tolerance in _Ceratopteris richardii_ Wild-Type and STL2 Mutant

**Project Summary:** Our research focuses on the relationship between salt tolerance and calcium uptake in the plant, _Ceratopteris richardii_. It was found through morphological analysis and protein gel electrophoresis that a higher concentration of calcium in the nutrient medium can improve salt tolerance. Calcium’s role in activating the SOS signal transduction pathway, one that deals with salt stress, can provide an explanation for this phenomenon. This would contribute greatly to agricultural production and the problem of world hunger.