

IMSAloquium

STUDENT INVESTIGATION SHOWCASE

April 2013

Dear IMSA Friends:

This year, we are proudly celebrating the twenty-fifth anniversary of IMSA's Student Inquiry and Research (SIR) Program. Our first IMSAloquium, then called Presentation Day, was held in 1989 with only ten presentations; this year we are nearing two hundred. In 1989, there was no Internet, the Human Genome Project (HGP) had just been launched, and Dr. Leon Lederman, one of IMSA's founding fathers and former director of Fermilab, won the Nobel Prize for his work on neutrinos. In 2013, students now use the Internet to conduct SIR projects with student colleagues and faculty advisors in China and Singapore; access HGP results to pursue advanced studies in genetics; and work side by side with scientists at Fermilab actively conducting research on neutrinos, quarks, and other mysteries of particle physics. What a difference twenty-five years makes! An important common thread connecting these past twenty-five years is the fact that these authentic research experiences have developed habits of mind in critical thinking, thorough analysis, and bold exploration that serve both students and humanity well. In the words of our mission statement, SIR clearly "ignites and nurtures creative, ethical, scientific minds that advance the human condition."

In this abstract book you will discover our students' demonstrated potential for exploring their unique passions, pursuing new interests, and both asking and answering profound questions. Working with extraordinary advisors, they conduct research at a level far beyond their chronological ages. In fact, several of our students have already published and presented their work at state, national, and international venues.

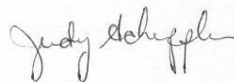
We are deeply indebted to our students' advisors. The strength of our SIR program lies with collaborative partnerships, and we are tremendously appreciative of our students' advisors and their institutions. During the past twenty-five years IMSA students have worked with thousands of advisors from hundreds of institutions, and the attention, guidance, and support they have given our students is both inspiring and humbling. We thank all the experts and leaders who join us in boldly applying innovative ways to nurture learners' talents and guide them as they reach extraordinary levels of achievement. When working together as a collective community, we have the vision, resources, and influence to shape education in ways that truly enable students to "learn how to learn" so they can confront present and future challenges that impact our local and global communities and most certainly improve the quality of life on our planet.

As you read the abstracts, we are confident that you will share our appreciation and admiration of our students' work. These young men and women have demonstrated that they take our mission seriously and are eager to tackle unsolved problems, address challenging issues, and contribute to an ever-growing body of knowledge. Working with their advisors, our students experience real-world problem solving, collaboration, and scholarship and for many, this work is a life-changing event. We trust that you will see for yourself that they are well-prepared to solve the challenges that our world will face in the future, that they are well-prepared to succeed in, or create, careers that do not yet exist and that they will, above all, strive to "advance the human condition."

Sincerely,



Glenn W. "Max" McGee, Ph.D.
President



Judith A. Scheppler, Ph.D.
Coordinator of Student Inquiry & Research

Illinois Mathematics and Science Academy
The World's Leading Teaching and Learning Laboratory for Imagination and Inquiry

Twenty-fifth Annual IMSAloquium

May 2, 2013

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Inside Back Cover – IMSA Map with Room Locations Highlighted

IMSAloquium cover designer is Chris Reader, IMSA staff member.

The cover was inspired by *Cytoskeleton Minicatalog 2013*, Cytoskeleton, Inc.

IMSAloquium logo design by Stephanie Chang and Hon Lung Chu (IMSA Class of 2007).

Twenty-Five Years of Student Inquiry and Research

The Student Inquiry and Research (SIR) program has been an integral part of student personalized learning at IMSA since the 1989 academic year. Since its inception with seven students, SIR has grown into a program that encompasses all disciplines, includes nearly three hundred participants each year, and participation by each graduating class is about 90%. Credit is now offered for participation in SIR in the summer, and Summer SIR is growing.

Our students' accomplishments have flourished. They do not have to wait until they graduate from college to begin to make significant contributions to science, mathematics, the humanities, and the world around them. IMSA's young apprentice investigators open our eyes to what is possible, and the World is paying attention. Accomplishments by students participating in Student Inquiry and Research are numerous!

Authorship or Co-authorship in Publications (partial listing)

- *Analytical Biochemistry*
- *ASC Nano*
- *The Astrophysical Journal Letters*
- *Alpha Epsilon Newsletter*
- *Biology of Reproduction*
- *Ceramic Engineering Science*
- *Ceramic Transactions*
- *Circulation Research*
- *Critical Reviews in Oncology/Hematology*
- *El Conquistador (newspaper)*
- *Information Processing Letters*
- *Inorganic Chemistry*
- *Intelligent Engineering Systems Through Artificial Neural Networks*
- *Journal of the American Society for Mass Spectrometry*
- *Journal of Bone and Mineral Research*
- *Journal of Comparative Neurology*
- *Journal of Dispersion Science and Technology*
- *Journal of Experimental Secondary Science*
- *Journal of Physical Chemistry*
- *Journal of Vacuum Science and Technology B*
- *Learning and Leading with Technology*
- *Meteoritics and Planetary Science*
- *Molecular Vision*
- *Monaldi Archives of Chest Disease*
- *NATO Science Series*
- *Nature*
- *Neuroscience Research Communications*
- *The Open Virology Journal*
- *Physics in Medicine and Biology*
- *Polyhedron*
- *The Science Teacher*
- *Biographies of the Citizens of Lee County Illinois: Through the Years*
- *NCSSMST Journal*
- *Traditions, Transitions, and Technologies - Themes in Southwestern Archaeology*

“Student Inquiry and Research: Developing Students' Authentic Inquiry Skills” authored by Judith A. Scheppler, Susan Styer, Donald Dosch, Joseph Traina, and Christopher Kolar, is among only eighteen inquiry-based programs nation-wide to have a chapter in the National Science Teachers Association book *Inquiry: The Key to Exemplary Science* (2009, NSTA Press).

“Student Inquiry at the Illinois Mathematics and Science Academy,” authored by Judith A. Scheppler, Donald Dosch, Susan Styer, and Steve Rogg, is among only fifteen high school models in the nation to have chapters in the National Science Teachers Association book, *Exemplary Science in Grades 9-12* (2005, NSTA Press).

Portraits of Great American Scientists (2001, Prometheus Books) contains biographies of fifteen American men and women motivated to excel in diverse fields of science. This book was the collaborative student effort of fifteen participants in IMSA's Student Inquiry and Research Program.

Presentations (partial listing)

- Adventures of the Mind Conference
- American Academy of Pediatrics
- American Association of Anatomists Regional Meeting
- American Association of Pharmaceutical Scientists
- American Chemical Society
- American Institute of Aeronautics and Astronautics
- American Physical Society
- American Psychiatric Association
- American Society of Cell Biology
- American Society of Echocardiography
- American Society of Microbiology
- 10th Annual Dabrowski Conference
- Eighth Annual Lewis Landsberg Research Day at Northwestern University
- Artificial Neural Networks Intelligent Engineering
- Aspen Conference on Perinatal Research
- Association for Chemoreception Science
- Association of Professional Sleep Societies
- Beckman Medical Research Symposium
- Conference on Smart Systems for Bridges, Structure and Highways
- Experimental Biology Meeting of the American Society of Biochemistry and Molecular Biology
- Great Lakes History Conference
- History of the Atomic Age - Chicago Historical Society
- IEEE Engineering in Medicine and Biology Society
- IEEE Nuclear Science Symposium
- Illinois Association of Gifted Children
- Illinois Section of the Mathematics Association of America
- Illinois Workshop on Regenerative Biology and Tissue Engineering
- Innovations in Medical Education
- International Conference on Electron, Ion, and Photon Beam Technology and Nanofabrication
- International LAM Research Conference
- International Signal Processing Conference
- International Students' Science Fair
- International Water Forum
- Japan Rits Super Science Fair
- Joint NSRC Workshop on Nanoparticle Science at Argonne National Laboratory

- Junior Academy of Science at AAAS
- Junior Science and Humanities Symposium
- Keystone Energy Board
- Meteorological Society Meeting
- Midwest Drosophilae Conference
- Midwest Society for Pediatric Research
- National Academy of Engineering Grand Challenges Summit
- National African American Studies Conference
- National Association of Biology Teachers
- National Conference on Undergraduate Research
- Native American Studies Conference
- NATO Network of Excellence
- NCSSSMST Student Research Symposium
- Nessel Research Forum
- Pediatric Society
- Rose-Hulman Institute of Technology Undergraduate Mathematics Conference
- Rush University Research Forum
- Sakharov Readings
- STEM Summit 2013: An Integrated Approach
- Society for Integrative and Comparative Biology
- Society for *In Vitro* Biology
- Topical Workshop on Electronics for Particle Physics
- University of Illinois at Chicago College of Dentistry Clinic and Research Day
- University of Wisconsin at Madison 2011 Synchrotron Radiation Center Users' Meeting
- WaterCon 2011
- Water Environment Federation Technical Exhibition and Conference
- World Conference on Science
- Young Women in Science and Technology

Competitions (partial listing)

- ACT-SO (Afro-Academic, Cultural, Technological and Scientific Olympics)
- American Concrete Institute's Concrete Projects Student Paper Competition
- iBioGENEius
- Intel International Science and Engineering Fair
 - 21 finalists since 2008
 - 1 fourth place (individual) category award, 1 (team) third place category award
- Intel Science Talent Search
 - 47 semi-finalists and 12 finalists since 1989
 - Finalists have placed first (1993), fifth (1998), third (1999), and second and sixth (2005)
- Jack Kavanagh Memorial Youth Baseball Research Award (Society for American Baseball Research)
- Junior Science and Humanities Symposium
- Midwest Research Competition: Positive Impact
- National History Day Competition
- Neuroscience Creativity Prize
- Neuroscience Research Prize
- Percy Julian Symposium
- Siemens Westinghouse (established 1998-99)
 - 50 regional semi-finalists resulting in 7 regional finalists and 1 national semi-finalist
- Young Epidemiology Scholars