



beyondbenign
a warner babcock foundation



2008 annual report



In 2008 Beyond Benign interacted with educators, students, community members and industry leaders, establishing deeper relationships and shared goals around a more sustainable future through green chemistry.

the 12 Principles of Green Chemistry

Pollution Prevention at the molecular level.

Atom Economy.

Less Hazardous Chemical Synthesis.

Designing Safer Chemicals.

Safer Solvents and Auxiliaries.

Design for Energy Efficiency.

Use of Renewable Feedstocks.

Reduce Derivatives.

Catalysis is generally better than stoichiometric.

Design for Degradation.

Real-time Analysis for Pollution Prevention.

Inherently Safer Chemistry for Accident Prevention.

This report shares experiences, quotations and snapshots of the people who have been touched this year by the generosity of our industry partners and donors. These experiences enrich lives, empower change and create legacies that reinforce our mission of a sustainable future through green chemistry and a revitalization of science through green technologies.

Our efforts, you will find, have a global reach, but one vision is common throughout; science education is the key in creating an environmentally, socially, and economically prosperous world. For, as big as the challenges to our society are, the solutions are within the next generation's grasp.

We are honored to engage in this work with our donors, grantees and many friends and supporters who share our conviction that a thriving environment, vibrant communities and an abundant economy are attainable through scientific leadership.



Beyond Benign carries out programs in three main focus areas:

K-12 Curriculum and Training

Sustainable science concepts will be integral knowledge for all future scientists and educated citizens. We believe that education of these topics must begin at the K-12 level. Through Beyond Benign's K-12 Curriculum and Training programs, a number of lesson plans, curriculum materials and training opportunities are presented to the K-12 educational community to aid in the implementation of science driven by the principles of Green Chemistry throughout the K-12 educational system.

Community Outreach and Communications

Community education is an essential piece to an environmentally, socially and economically prosperous world. Beyond Benign seeks to educate the community to inspire future scientists and to create more informed consumers and voters who are able to support a growing industrial market based in concepts of Green Chemistry and sustainability.

Workforce Development

Green Chemistry in practice implies designing safer, economical, efficacious and efficient processes and products. All of these aspects are symptoms of good product design and good manufacturing processes in industry and can result in economic benefit for industries that implement these practices. Green Chemistry can be a tool for regional economic development and job creation. Education and training at the academic and professional level are required to support a workforce that can sustain industries driven by the principles of Green Chemistry.

Beyond Benign's Core Values

Beyond Benign specializes in curriculum development, outreach, education and training. Beyond Benign's unique educational approach produces materials and trainings that are:

Audience Driven

Based on core sustainability values of environment, economics and social equity

Useful for multiple learning styles

Relevant to science in society in order to demystify science

Activity based approaches (both content and curriculum)

Based on state-of-the-art industrial approaches to Green Chemistry

Specialized in adult educational approaches (andragogy)

k-12 curriculum & training



The curriculum and teacher training work of Beyond Benign seeks to deliver teaching and learning tools to K-12 educators in order that they may share dynamic science experiences with their students with an emphasis on objective reasoning through the consideration of economy, society and the environment in equal measure.

The current curriculum units at Beyond Benign have been developed in conjunction by teachers and curriculum specialists so that relevant curriculum materials are produced. The content is based on state-of-the-art approaches to science, which are activity-based, interactive and versatile for multiple learning styles. The content is constantly updated by teacher professionals and scientific experts in order to keep the content relevant.

The current Beyond Benign Middle School and High School Curriculum includes:

- Green Chemistry
- Green Math and Engineering
- Biotechnology
- Watershed Science
- Forensics Science

The Beyond Benign staff implemented three new curriculum projects in 2008, and made continuous updates to all of our current curricula in order to maintain their integrity as living documents.

Beyond Benign staff and teacher curriculum consultants convened in the summer of 2008 to make preliminary plans for a Green Math & Engineering unit which uses green ideas, technologies and decision



making processes in a math classroom setting. There will be Middle School and High School versions of these materials which will be designed to engage students in math through project-based scenarios and integrated concepts. These units will be beta-tested in the spring of 2009 and a pilot teacher professional development workshop will be held in the summer of 2009.

Beyond Benign staff has also developed a middle school curriculum around the topic of Medical/Pharmaceutical Biotechnology. This curriculum is a 12 lesson sequence that introduces middle school students to the concepts of biotechnology and how it can be used to solve health problems. The unit is multi-disciplinary in nature and addresses national curriculum standards in Science and Social Studies. These lessons will be tested in the classroom in the spring of 2009 with an expected roll-out date in the summer of 2009.

In addition, in 2008, Beyond Benign staff added lesson plans to the High School Green Chemistry curriculum "Solutions in Green Chemistry" which address Presidential Green Chemistry Award winners in order to connect students with the latest green chemistry techniques coming out of industry. All green chemistry curriculum materials have also been translated into Spanish and are available for free download on the K-12 pages of the Beyond Benign website.

An Inclusion and Adaptation program on video conferencing and web casting among global schools to promote program sharing and inclusion was started in 2008. This program is designed to allow middle school students with different learning abilities and styles, and from diverse economic and cultural locales, the opportunity to experience a different world by connecting classrooms.

teacher training institutes



“I will use these activities with my students because they are excellent activities to encourage my students to think about creative ways to approach science.”

Jessica Gnanadickam
Sydney, Australia

“The days were long and packed; I’m exhausted. But that’s OK because everything is usable.”

Jim Smalls
St. Louis, Missouri

“...the part where we took a lab we currently use in the classroom and made it green was so hard. I love a struggle. Thanks for making it all so relevant.”

Aaron Warner
Terre Haute, Indianapolis

In 2008 Beyond Benign held 7 teacher-training institutes in Green Chemistry, Biotechnology and Forensics Science. A total of 213 middle and high school teachers were sponsored by industry partners and received all travel, training and materials through this sponsorship.

Recipe for Sustainable Science

Breckenridge, CO, July 30 – August 4, 2008)

24 National and international teachers participated in a week long institute, which gave Middle school teachers an understanding of the concepts of green chemistry and a curriculum mechanism to help them introduce these concepts to their students. Teachers from the US, Germany, Ireland, Canada and Puerto Rico enjoyed a week in Colorado where collegial friendships were formed and resources were shared to improve everyone’s classroom performance. A partnership of teachers was formed through this year’s institute which has led to a successful grant proposal which will connect these international classrooms through webcam technology in order to work on green chemistry in the future.

Solutions in Green Chemistry

Breckenridge, CO, July 30 – August 4, 2008

25 International teachers participated in a week-long institute which taught high school chemistry teachers the 12 principles of green chemistry, and asked them to take a proactive and critical look at their own laboratory practice in the school setting. Teachers were shown engaging and standards-based methods to teach students about the 12 principles as well. This institute took place in Breckenridge, Colorado and included teachers from Thailand, Ireland, Australia and all over the U.S. A keynote speech was given by Dr. John Warner, founder of the 12 principles of green chemistry and a special talk was given introducing the concept of Biomimicry.

Green Chemistry in Canada

November 12 – 14, 2008

50 teachers from the Thames Valley School district in London, Ontario participated in a two-day Green Chemistry workshop on the Middle School and High School Beyond Benign curriculum. Focusing this heavily on one school district made for a ground-swell of impetus in implementing the materials presented. Beyond Benign staff also provided a large supply of materials that can be used by any teacher in the district to implement the activities in their classroom.

Biotechnology

Groton, CT, November 21, 2008; La Jolla, CA, December 5, 2008

Beyond Benign staff presented 2 one-day High School Biotechnology workshops for teachers on the east and west coasts. 48 teachers were trained on this interactive, investigative curriculum unit. All attendees also received lab kits that enabled them to do cutting edge electrophoresis activities with their students.

High School Forensic Training Partnership

July, 2008

Forensics science, not generally considered a sustainability-related science, is a great tool for introducing students to the field of science. Teachers comment that introduction of forensic science in schools has increased the participation of students in higher-level sciences. The Connecticut State Forensic Laboratory, in partnership with the Pfizer Foundation and administered through Beyond Benign, trained 15 teachers in a two-week program in Groton and Meriden, CT focusing on biology/DNA and chemistry/trace evidence. Participating teachers were from Connecticut, San Diego, Memphis, Canada, Australia, Germany, and England. An additional 14 teachers from Nebraska, Indiana, Connecticut, St. Louis, Ireland, and Germany, took part in one-week of the Crime Scene Reconstruction and Applied Forensics program at the same locations.

A Train-the-Trainers and Kit Development Workshop was held in order to train a cadre of teachers that will be able to train other teachers in their region on the forensics curriculum. Eleven teachers from Ireland, England, Canada, Nebraska, Connecticut and Michigan came together for the train-the-trainer session and kit development.

CSI Ireland

National Science Week, November 2008

Three one-day forensic workshops, each with twenty teachers attending, took place in Ireland at the Limerick Institute of Technology, University College Cork, and the Institute of Technology Tallaght. The goals of the workshops were to educate teachers on the Forensics curriculum and to facilitate the adoption of the curriculum into the new Ireland national plan for science reform.

240

is the average number of individual students a single secondary school science teacher teaches each academic year.

447

teachers are currently and consistently implementing our curriculum after receiving training in one of our workshops.

outreach & communications



“Thank you, thank you, thank you! [The Beyond Benign staff] did such a fabulous job introducing the students to green chemistry. They both have a wealth of information, but yet can translate their knowledge into terms that are understandable to kids. Hands-on teaching impacts kids greatly. I also learned a lot from them.”

Mindy Hannan
Charlton Middle School, MA

Community education is an essential piece to an environmentally, socially and economically prosperous world. Beyond Benign seeks to educate the community to inspire future scientists and to create more informed consumers and voters who are able to support a growing industrial market based in concepts of green chemistry and sustainability.

Our outreach to all parts of the community is centered on the concepts of green chemistry and sustainable science because only through sustainability-minded actions and decisions will we meet the demands of current and future society for materials, medicines, and social and economic justice.

The goals of Beyond Benign’s outreach program are to:

Educate communities about green chemistry and sustainability; recognizing their role in creating a future with non-toxic, environmentally benign products.

Inspire young people to pursue studies in the physical sciences with a focus on sustainability.

Involve college students in the teaching process because college students can be significant role models to younger people.

Expose college students to the larger scientific community, which allows them to witness first-hand the advances and research being done to further environmentally benign science.



Beyond Benign staff regularly holds workshops in classrooms and at community and public events to educate citizens, inspire students and inform the public on sustainability and green chemistry. In collaboration with a number of college student volunteers through Beyond Benign's Outreach Ambassador Program, a total of 2,137 students, community members, educators and citizens were reached through Beyond Benign's outreach efforts in a total of 26 outreach visits. Key events involved a Green Chemistry Day at the Museum of Science with over 300 high school students, teachers and members of the public; a green chemistry workshop at the Bioneers by the Bay Conference involving over 50 community members; and involvement in a Science Carnival as part of the Cambridge Science Festival engaging hundreds of members of the general public.

Beyond Benign introduced a new program during the summer of 2008. The Green Chemistry in Massachusetts Schools program was made possible through an EPA Supplemental Environmental Proposal (SEP) and was carried out in collaboration with Quincy High School (Quincy, MA). The goals of the program are to develop green chemistry educational materials and programming within the state of Massachusetts for implementation into the school systems and to educate and inspire future scientists and citizens through green chemistry. The first phase of the program began in the summer of 2008 with a 6 - week program involving 3 high school teachers, 10 high school students and 8 middle school students.

"I think it gives the student's hope that there are scientific and technical solutions to the many problems we face."

Dan Raizen
Waldorf High School, MA

selected outreach 2008



Selected Elementary, Secondary & Community Events

Boston Museum of Science

National Science Week

Green Chemistry Day

Cambridge Science Fair

Bioneers by the Bay

GreenSchool's GreenFest

Boy Scouts College & Career Fair

Girl Scouts Leadership Fair

Concord Science Fair

Outreach Activities

Lecture & Outreach Activities

Outreach Activities

Lecture & Outreach Activities

Lecture & Outreach Activities

Outreach Activities

Lecture & Outreach Activities

Outreach Activities

1867

students in 41 schools learned about green chemistry and sustainability through interactive outreach and hands-on activities this year in the greater Boston area.

Waldorf High School

Linden Elementary School

Parker Middle School

Lowell Catholic High School

Northeast Vocational High School

Maimonides High School

Bishop Guertin High School

North Quincy High School

Benny Dover Middle School

Charlton Middle School

Lesson & Laboratory

Lesson & Laboratory

Lesson & Laboratory

Lesson & Laboratory

Lesson & Laboratory

Lesson & Laboratory

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Lesson & Laboratory

Lesson & Laboratory

Workforce development 2008



By focusing equally on environment, economics and social equity, green chemistry can be a tool for regional economic development and jobs creation. Education and training at the academic and technical level are required to support a workforce that can meet societies needs for sustainable technologies.

Beyond Benign supports the regional and national Green Chemistry Education Network (GCEdNet), a network of green chemistry educators that collaborate, share curriculum and best practices in order to advance green chemistry education in academia. Through collaborations with the GCEdNet faculty and the New Hampshire College and University Compliance Assistance Cooperative Program (NHC3UA), Beyond Benign staff helped to run a Green Chemistry Workshop for twenty college faculty members in New Hampshire (August 22, 2008).

Selected Community Workforce Events

Massachusetts Rehabilitation Commission

Counselors, Lowell

Regional, Taunton

Regional, Devens

Regional, Holyoke

Boston Museum of Science

Educators' Open House

Corporate Science Fair

NE Section American Chemical Society, Undergraduate Day

Workshop

Seminar

Seminar

Seminar

Seminar

Seminar

Workshop

270

workforce counselors, adult learners and science & technology professionals attended lectures, seminars and workshops focusing on green chemistry and workforce development.

key dates 2009



Curriculum Workshops

Association of Science Teachers Conference, U.K.	January 7-11, 2009
Irish Science Teachers Association Conference	March 18-22, 2009
International Technology Educators Association	March 25-28, 2009
National Science Teachers Association	March 19-22, 2009
Green Math & Engineering Teacher Training Institute	July 9-10, 2009
Summer Green Chemistry Curriculum Institute	July 29-Aug 2, 2009
National Science Week, Ireland	November 16-20, 2009
Watershed Workshop at Carnegie Science Center	TBD

Selected Outreach Events

Boy Scouts Math & Science Merit Badge College & Career Expo	February 21, 2009
Girl Scouts Senior Leadership Conference Science & Creativity	March 7, 2009
at the Boston Museum of Science	March 26, 2009
Cambridge Science Festival	April 25-May 2, 2009
Green Chemistry in Massachusetts' Schools Workshop	June 26, 2009

National & International Events

American Chemical Society National Meeting	March 22-26, 2009
EPA's P3 National Sustainable Design Expo	April 18-20, 2009
Green Chemistry & Engineering Student Workshop	June 22, 2009
Green Chemistry & Engineering Annual Meeting	June 23-25, 2009
Green Chemistry Workshop, Mumbai India	December, 2009

2009 & beyond



The year ahead is filled with curriculum workshops, outreach events and activities and new educational opportunities for Beyond Benign. 2009 will see the launch of Beyond Benign's newest curriculum and training unit in Green Math and Engineering. Curriculum opportunities are being explored that bring together concepts in biology, chemistry and physics in new and exciting ways. Beyond Benign's outreach program continues to expand its reach, with collaborative initiatives being expanded beyond our geographical region. Beyond Benign will continue to use web-based strategies and expand to include a regularly scheduled distribution of a newsletter. In 2009, Beyond Benign will work with the EPA as an official co-sponsor of the EPA's P3 (People, Prosperity and the Planet) National Sustainable Design Expo, helping to plan the Classroom on the Mall which will feature outreach activities open to the general public and K-12 classrooms. Beyond Benign staff, in collaboration with the American Chemical Society's Green Chemistry Institute (GCI), will help to plan and run the Green Chemistry & Engineering Student Workshop held annually as part of the GCI's National Meeting in June. Future work in workforce development and academic and technical training involves collaborations for program development, course and curriculum development, along with the implementation of a student fellowship program at Beyond Benign.

The years ahead are filled with opportunities for expanding the reach of all aspect of Beyond Benign's curriculum, training and outreach. Beyond Benign will continue on its path to provide materials, trainings and experiences for educators, citizens and students in order to create a future where sustainability is a part of every aspect of a student's educational experience. This future is essential for creating an environmentally, socially and economically prosperous world.

contributors & collaborators



Advancing Green Chemistry
Biomimicry Institute
Boston Museum of Science
Boy Scouts
Cambridge College
Fisher Scientific Education
Girl Scouts
Green Chemistry Education Network
GreenSchools
Guiding Green
Maimonides High School
Massachusetts Rehabilitation Commission
Pfizer Foundation
Quincy High School
Revolving Museum
Waldorf High School
Warner Babcock Institute
Willard School

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