STOCKHOLM JUNIOR WATER PRIZE

The Stockholm Junior Water Prize is the most prestigious award in the world for a water-related science project at the high school level.

# 2011 Year in Review

*2011 marked the 15th year that WEF and its Member Associations have participated in the Stockholm Junior Water Prize competition. Now, over a decade since the award's inception, the U.S. competition has grown into a well-established event. The youth prize is a highly visible initiative that demonstrates a commitment to innovation and furthering water science.*

## Alison Bick's Development and Evaluation of a Microfluidic Co-Flow Device To Determine Water-Quality Earns the SJWP International Title

High quality water free of contaminates, that is fit for human consumption and use, which will meet the needs of a rapidly expanding world population, is a top priority in today's society. Being able to determine if water is suitable for consumption and use by people is essential. The various devices and methods currently available to determine if water meets the standards for use in daily needs are somewhat costly, not necessarily timely, and sometimes require sophisticated knowledge and equipment.

Alison Bick, who attends Millburn High School in Short Hills, N.J., set out to address the previously mentioned challenges of determining water quality through her research project which was awarded first place in the U.S. Stockholm Junior Water Prize Competition 2011. During a 3-year time period, Ms. Bick conducted research in detection of coliform bacteria and *E. coli* in water supplies and developed water quality assessment equipment using common items, which were very cost-effective.

Alison developed an initial assessment device by using a shoebox, fluorescent and phosphorescent paints, and a cell phone. Unfortunately, this device could not determine if the water being tested was safe for use. Alison engaged in further research, which indicated the use of the chemical Colilert-18 would produce a color change when exposed to water contaminated with coliform and *E. coli* bacteria. The challenge was detecting the color change; it occurs very rapidly. The rate of color change was addressed by the development of a microfluidic co-flow device. A microfluidic co-flow device allows small amounts of fluids to flow through a tube at a very slow rate. One channel of fluid contains a bacteria indicator; the other channel contains the water to be tested. The fluids are simultaneously brought into contact with each other and a chemical reaction results that emits a characteristic color indicating the presence of coliform and *E. coli.* A cell phone can actually be used.

Alison Bick (right) of New Jersey receives the SJWP International Award from H.R.H. Crown Princess Victoria of Sweden.

to photograph the event, thus eliminating the need for a person to make a visual assessment, which can be difficult.

Let's look more closely at some of the processes and technology Alison used to complete her impressive research project. Using the latest technology in computer simulations, Alison developed the model for the microfluidic co-flow device. Numerous tests were conducted to produce the optimum design. The device actually had three channels, two of which contain Colilert-18 mixed with water and the third contains the water to be tested. A cell phone is placed above the channels. As the solutions mixed, and a color change was recorded, the data were analyzed to determine the concentration of coliform and *E. coli*.

*(see "Microfluidic" on page 2)*

## More Inside…

# Students Meet in the Windy City

*Photo by Oscar Einzig*

In June of 2011, 50 students representing the United States, Puerto Rico, and the U.S. Virgin Islands converged in Chicago to compete for the title of U.S. Stockholm Junior Water Prize winner, and a chance to receive an all-expense paid trip to Stockholm to compete in the international competition.

The competition, hosted by the Illinois Water Environment Association, brought some of the countries brightest high school science students together for the 3-day event, providing them with the opportunity to network with water quality professionals and other students with like-minded interests, and showcase research projects that face many of today's toughest water challenges.

To open the event, students learned about the famous Chicago River reversal and participated in a challenge to re-create that reversal using clay, water, and a variety of other materials. Other highlights of the experience were various competitions where students could participate in teams to win prizes while visiting Millennium Park, Lurie Gardens, the Shedd Aquarium, and the Field Museum of Natural History. To conclude the event, students, teachers, and guests gathered at an awards ceremony to enjoy dinner and discover who would be representing the United States at the international competition in Stockholm.

Next year's SJWP competition will be held June 17-16 in Boston.. The New England Water Environment Association has been hard at work planning the event and is looking forward to another great competition.

## Bridging Water Science and Fun Together in Chicago

*Photos by Ted Denning for the Illinois Clarifier*

### Microfluidic
(continued from page 1)

To determine the accuracy of her designed product, Alison compared the results from her microfluidic co-flow device with known concentrations samples and testing procedures used by government and industry. The results from Alison's work were spectacular: 98% accuracy. This is very significant, because it meets the government standard for the Colilert-18 procedure. Designing the microfluidic device, determining the accuracy, and establishing experimental methodology requires the extensive use of higher level mathematics. An added bonus is that Alison's procedure costs about .20 per test. This compares very favorably to the current cost of $20 per standard water test.

Alison's work will have major implications for water testing in laboratories and testing various water sources such as lakes, rivers, ponds, and streams. As the procedures and detection devices that she developed are improved upon, cost will decrease, and accuracy and convenience will increase. Testing water for contaminments will be easier in many different situations.

Alison had the perseverance and dedication to conduct intensive research and develop a usable product with very practical application. Alison utilized mathematics, technology, scientific principles, and engineering design to realize success in her project. Without a doubt, Ms. Bick is a rising star in the world of science, technology, engineering, and mathematics. The first place award is well-deserved recognition.

# Eye on the Prize: A Look Back at 2011 Achievements

The following highlights are a snapshot of this year's U.S. SJWP Program:

Promoted the SJWP competition at environmental education-related conferences and workshops, including the National Science Teacher Association's annual conference, which draws more than 10,000 science teachers from around the country.


Enhanced social media avenues to facilitate new SJWP participants and SJWP alumni communication and to keep present and potential participants of the competition informed of information regarding the program.

Successfully organized the 2011 U.S. SJWP competition in Chicago in partnership with the Illinois Water Environment Association.

Record number of state finalists attended the national competition. The competition involved 50 students representing the United States, Puerto Rico, and the U.S. Virgin Islands.

U.S. Winner, Alison Bick, was named the SJWP International winner in Stockholm in late August.

Travel sponsorship to the National Competition for the state winners and teachers provided by WEF Member Associations.

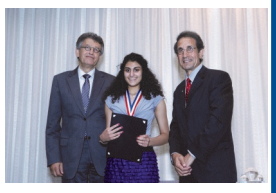

Sponsored with support from ITT Corporation, Delta Air Lines, and The Coca-Cola Company, the U.S. competition winner, Alison Bick, who was awarded the top prize for her ground-breaking research.

Partnered with the World Water Monitoring Day public education program to include an SJWP informational flyer in each monitoring kit distributed. Last year, the kits were used by over 212,000 participants in 85 countries.

## Goals for the Year Ahead ...

1. Build on the previous success and experience of the SJWP program to organize the 2012 U.S. competition in collaboration with the New England Water Environment Association in Boston.
2. Increase participation in regional and state SJWP competitions to engage more students in water-science research.
3. Improve awareness of the program by reaching out to home school and private school students and teachers.
4. Enhance the SJWP website to optimize communication regarding the competition.
5. Continue to build an SJWP alumni program with links to WEF's young professionals committee to help past participants stay connected and encourage their continued involvement in the water quality community.
6. Keep the competition in line with WEF's strategic initiatives and keep the competition focused on water science issues.

### New Award is Presented at the SJWP Competition in Chicago!



**The SJWP competition is proud to serve as the venue for the Bjorn von Euler Innovation in Water Scholarship Award sponsored by ITT Watermark. This $1000 scholarship recognizes projects that demonstrate a unique passion for education and spirit of creativity and innovation.**

**The Water Environment Federation would like to congratulate Leila Musavi from Orono, Maine, who was awarded this scholarship along with a $500 bonus as the first recipient of the award.**

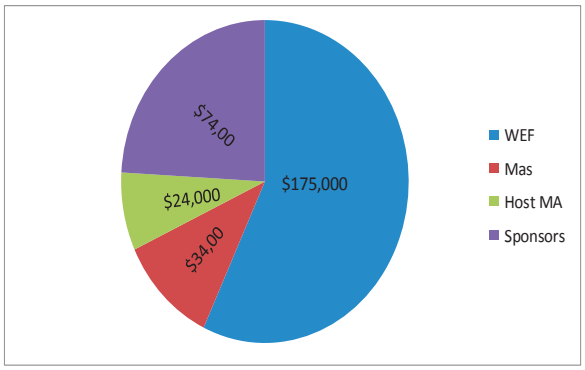
# A Sound Investment in the Future of Water Quality

Now, more than ever, organizations must carefully weigh how each dollar is spent. This holds true with the partnering organizations that sponsor the U.S. SJWP program. In today's fluctuating economic times, these organizations recognize the need to make wise decisions, and they have identified the Water Prize as a critical investment. Each organization has seen the true value of this asset in the faces of the young scientists they support, as well as the marked improvements in water quality.

The program is truly a collaborative effort, beginning with WEF's strong budgetary commitment and staff resources. This foundation is enhanced by the generous support of the U.S. national sponsors, ITT Corporation, Delta Air Lines, and The Coca-Cola Company. These sponsors not only provide monetary and in-kind contributions, they also have a vested interest in the program and donate their time and industry expertise to helping the program grow.

Each WEF Member Association (MA) also plays a critical role in supporting the program. By running their state competitions and providing airfare to the national competition for both the student winners and their teachers, MAs have a direct connection to their state's future industry leaders. Many associations also celebrate the importance of this program by providing special awards for their state winners and making donations to the SJWP program throughout the year.

**2011 U.S. SJWP Program Funding**




# Featured Findings: SJWP Finalists' Research

**Jenifer Brown: Modification of Cotton Fabric by Silane Coupling Agents, and Assessment for Use in Oil Spill Remediation**

To find the best modified fabric for this application, hydrophobic and oleophilic surfaces were prepared from cotton. Cotton was chosen as the best natural fabric for this use; previous literature shows its effective surface modification using silanes. Pure cotton fabric was modified using Ethylperfluorooctadecylsilane, Ocatdecyltrimethoxysilane, 10-(Carbomethoxy)decyldimethoxysilane, and Chlorotrimethylsilane, , and oil soak trials were performed on wet and dry modified fabrics to determine which had the highest oil adsorbing

**Collin McAliley: Florida Harmful Algal Bloom Mitigation, Year 7: Detection of PbTx-3 Via Cysteine-Induced Gold Nanoparticle Aggregation Inhibited by BTX-B2 Formation**

The purpose of this project was to investigate and invent an entirely new, simple, and inexpensive method for detecting brevetoxin PbTx-3, the most common of the brevetoxins and the harmful element of Florida harmful algal blooms. The project was successful and the new detection process should allow greater access to brevetoxin research for the scientific community and other user groups. The detection of the presence of brevetoxin PbTx-3 in the environment and in laboratory procedures will be possible using the procedure developed by this project.

**Leila Musavi: Development and Optimization of Gold Nanoparticle-Modified Carbon Electrode Biosensor for Detection of *Listeria monocytogenes***

A gold nanoparticle-modified screen printed carbon electrode (SPCE) biosensor was developed and optimized for amperometric detection of *Listeria monocytogenes*. A sandwich immunoassay was created on the electrode surface with self-assembled monolayers. The second antibody was labeled with horseradish peroxidase enzyme and a hydrogen peroxidase-ferrocene dicarboxylic acid (FeDC) mixture was used as substrate for the enzyme. Results showed that the developed protocol could specifically detect *Listeria monocytogenes*, and the SPCE carries huge potential for real-world pathogen detection.

**Nishith Reddy: CdS/ZnS Quantum Dot-Photoexcited Glucose Oxidase Biosensor for Ag+ Detection in Contaminated Aqueous Environments**

The objective of this project was to develop a biosensor for detecting silver contamination in aqueous environments such as groundwater and surface water using known inhibition of glucose oxidase by silver and the photoexcitation characteristic of nano-scale semiconductors, specifically CdS/ZnS core-shell quantum dots. As a biosensor, this detection mechanism is capable of providing timely, on-site analysis of silver concentrations for regulation and remediation.

The U.S. Stockholm Junior Water Prize is sponsored by the Water Environment Federation and its Member Associations, with support from ITT Corporation, Delta Air Lines, and The Coca-Cola Company.

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