

**Testimony of
Ms. Anne de Sostoa Manwell
Before the House Committee on Science, Space and Technology
On the role of science competitions in STEM education
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Good morning committee members, colleagues and students. I am Anne de Sostoa Manwell and I have been teaching Biology at Stuyvesant High School, a specialized NYC Public School of math, science and technology, for fourteen years. All students at Stuyvesant took a qualifying test to be offered a seat at the school. We have a rich tradition of student research and success in student science competitions like Intel/Science Talent Search, Siemens Competition and ISEF. We can boast of five Nobel Laureates among the many scientists, mathematicians, engineers and physicians who are alumni.

But schools like Stuyvesant and specialized high schools in all of your states do not operate in a vacuum. We need students prepared by elementary and middle schools to feed our programs. I would like to take this opportunity today to speak to you about the role competitions like Toshiba ExploraVision play in building the skills needed for students to participate in our programs.

We at Stuyvesant have found that engaging our students in competitions allows them to be creative, think broadly and critically, work in teams, develop time-management skills, take ownership of a project, and be proud of their work. No one now at Stuyvesant remembers when ExploraVision became a part of the 10th grade Research Chemistry curriculum but it was probably very close to its 1992 launch. The current Research Chemistry teachers, Samantha Daves and Dr. Zhen Chuan Li, have continued to use ExploraVision as a powerful motivating force to develop student skills in scientific thinking.

The ExploraVision Competition requires teams of students to take a current technology and push it 20 years into the future. This nurturing of a young person's imagination, starting as young as kindergarten, ensures that as she gets older, she will continue to ask questions and explore her world. Ms. Daves' teams bounced ideas off each other, brought in classmates from other sections, grilled parents and consulted online sources for their choice of current technology to develop. The 3Drenal team of Norine Chan, David Kurkovskiy and Alison Reed took an article found by Alison's mother on bioprinting and combined it with what they knew about adult stem cells and signaling molecules and began to see into the future.

Critically at this stage of their development, Ms. Daves gave the teams a timeline to complete the various stages of their project. The 3Drenal team recognized their different skill sets and divided up the labor accordingly. Alison was the artist, David provided overall organization and Norine did background research. They knew they could consult with other faculty members, especially the research coordinator, Dr.

Jonathan Gastel, for leads to more detailed information or to clear up any technical questions they had. Finally it was all together and sent off.

This initial phase can be done in any educational setting. With the motivation of the ExploraVision competition, any STEM teacher can engage students in the creative and innovative thinking necessary to look into the future.

On the day the awards announcement was made, there were numerous clutches of 10th graders crowded around computers to see results. They did quite well. 3Drenal was first in the Northeast region and both Dr. Li's and Ms. Daves' Research Chemistry classes had numerous honorable mentions. And there were many honorable mentions in Ms. Daves' regular Chemistry classes for whom the ExploraVision project was not required! Toshiba and the National Science Teachers Association (NSTA), ExploraVision's sponsor and administrator, were impressed with the numbers and helped arrange a press conference for all the students, parents, upper-classmen research students, and faculty. Speeches were made, reporters asked questions, pictures were taken and veggies were dipped.

The 3Drenal team and their classmate were pleased with their performance but the really difficult part had just started. The team had just four weeks to create a website to show off 3Drenal. They had won a Toshiba computer loaded with web-design software but they had little experience using it. Consultants were needed. Paul Oratofsky, SHS '67, helped with initial website design and later Digital Resources Incorporated, a company headed by Alison's father, David Reed, was enlisted to help with 3D imagery and website orchestration. After many hours after school and on weekends, either at school or the Chan's or Digital Resources Inc. the website was completed and submitted.

A few weeks later the 3Drenal team was surprised at school by Toshiba and NSTA representatives announcing their National Second Place in the senior division. This was at 10:30am, by 11:40 everyone knew the news and was congratulating David who was in my Molecular Science class. But now they had to build a prototype. A more detailed design had to be developed, materials to use had to be chosen and dimensions measured. Scott Thomas, the Chemistry/Physics chair, volunteered to teach Norine enough AutoCAD so that our very real 3D printer could build the printer corner controls for the future 3Drenal bioprinter. Everyone had to learn to wield an Exacto knife to cut foam-core for the printer cabinet. Finally they fashioned a clay kidney to represent 3Drenal's innovative product, a new kidney formed from the patient's own bone marrow stem cells that were stimulated to develop into the various kidney tissues, *in vitro*, by tissue specific signaling molecules and then assembled by the bioprinter.

The 3Drenal team had pushed an existing technology to future uses. They had to work as a team. They had to recruit experts to help them. They had to articulate their problem and innovative solution clearly, accurately and persuasively. They had to complete their project on time. They had to deal with unfamiliar technology and tools. They have accepted acknowledgement for their efforts. All these skills will serve them very well if

they continue in any of the STEM disciplines or for that matter in whatever discipline they choose to follow.

I hope you have time in your busy schedules to see the prototypes and listen to the ideas that the ExploraVision teams have brought to Washington and for which you have provided a national venue.