Sound Perspectives

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Acoustical Society of America Participation at the International Science and Engineering Fair

As in previous years, the Acoustical Society of America (ASA) participated in the Intel-sponsored International Science and Education Fair (ISEF) held in Phoenix, AZ, May 12-17, 2019. This event had 1,800 high-school students (grades 9-12) from more than 80 countries as finalists to present their research in different areas of pure and applied sciences. The finalists were competing for approximately US$5 million cash awards as well as other recognition. The ASA participated as 1 of about 70 Special Award Organizations (SAOs) to select winners in their own special area of interest. The ASA has been participating in the ISEF since 1978 (see ow.ly/vwXD30oQ5VR for past ASA award winners). When presenting the SAO awards, the ASA stands out as the first organization on the podium!

The professionally diverse ASA judging team (**Figure 1**) included Julie Liss, Arizona State University (ASU; Tempe), Xin Luo, ASU, Thomas Kaufmann, Otojoy (Phoenix, AZ), and myself, A.T. Still University-School of Osteopathic Medicine in Arizona (ATSU-SOMA). As the chair of the judging team, I presented the awards on behalf of the ASA at the SAO ceremony (**Figure 2**).

Out of 1,800 finalist reports in 22 scientific categories, each with several subcategories, a manual and electronic search was conducted to identify various projects related to acoustics. A total of 37 projects were identified, and these were reviewed in a manner similar to that described for the 2018 ISEF (Vipperman, 2018).

*Figure 1. The Acoustical Society of America (ASA) judges at the judging table. **Left to right**: Julie Liss, Thomas Kaufmann, Xin Luo, and Inder Makin.*

Figure 2. Inder Makin and the ASA award winners.

The first prize of $1,500 was awarded to the student trio, Haruka Hinami, Ayana Miyazaki, and Yui Tamada, Prefectural Nagasaki Nishi High School (Nagasaki City, Japan) for their project entitled *Novel Subtle Acoustic Communication: Successful Elucidation of the Cryptic Ecology of Runner Plant Bugs (Hallodapus spp.) with Emphasis on Their Stridulatory Mechanisms.* Their mentor, Tetsuya Nagashima, was awarded $500 and their school $200. In this unique insect bioacoustics and community science project, the team used several novel practical techniques to harvest sufficient specimens of runner harvest bugs (*Hallodapus* spp.), localize and study the morphology of insect noise-producing structures, and implement a setup for evoking the stridulatory phenomenon among the insects as well as measuring and characterizing the sounds. The team used a microphone pickup with a needle-based taper to capture the faint sounds. The team further went on to study the social impetus for stridulatory events among these runner plant bugs, which apparently are quite common in their city. Finally, from scanning electron microscope images, the team was able to hypothesize the mechanism by which the insects made the sounds. The project abstract is available at ow.ly/G3pv50uqUMd.

The second prize of $1,000 was awarded to Joonyoung Lee and Mincheol Park, Korea Science Academy of Science (Busan, South Korea), for their project entitled *SHOWPAM: System of High-Efficiency Ocean Wave Power with Acoustic Metamaterial.* Awards of $250 to their mentor Jongrim Lee and $100 to the school were part of the ASA prize. The group studied the area of power generation from ocean waves to understand the limitations of the current systems, leading to developing higher efficiency ocean wave-to-electrical energy conversion systems. The group's approach investigated the possibility of amplifying the ocean wave by designing a spatial structure to amplify the surface ocean wave, coined SHOWPAM. The group refined their geometric design for performance using COMSOL and then tested their prototypes in a self-designed wave-generating test bed. Prototypes were built as controls, and the power conversion efficiency was measured and compared to show a greatly increased (225%) power conversion using their SHOWPAM prototype. The project abstract is available at ow.ly/Sz0250uqUO6.

The third prize of $600 was awarded to Sauhaarda Chowdhuri, Westview High School (San Diego, CA), with the mentor Dom

David receiving $150 for the project entitled *PhonoNet: Deep Learning for Raga Identification in Indian Classical Music*, an analysis of vocal Indian classical music. This form of music usually has no written notes and is passed on from teacher to disciple, with no real possibility of learning the music at an individual level without a live expert mentor. First, individual 150-second-long segments of music in the frequency domain were created through Fourier transformation and then used as training blocks for a neural network. Because Indian classical vocal pieces can be longer than 30 minutes, algorithms were implemented to patch individual 150-second segments of audio data to document the full-length song. The purpose of this exercise was to enable individuals to learn and train in the Indian classical singing genre without the immediate need of an in-person singing expert as well as a means to memorialize the vocal music of well-known singers for the future. The project abstract is available at ow.ly/xcGF30oQ5Bd.

Finally, honorable mention from the ASA was made to Neil David Cayanan, Shaira Gozun, and E'van Relle Tongol, Angeles City Science High School (Angeles City, Philippines) for their project *Hibla: An Alternative Sound Absorption Material*. The team's mentor was Lolita Bautista. The highly animated team described the fabrication of a noise control barrier material using native and abundant natural materials (abacá, bamboo, and water hyacinth). After fabricating these samples with different ratios of polyester, the group performed standardized characterization for noise control (ASTM International tests for absorption, impedance, soundproofing, and reverberation), comparing their material with currently used synthetic material such as rockwool. The prototype materials were also tested for fire resistance and thermal insulation. Overall, the reformulated materials using primarily natural components proved better barriers compared with the existing materials used for noise control in structures. The abstract is available at ow.ly/EPIx30oQ5Ck.

In addition to the cash prizes, all the winners, including the honorable mention, have been invited to attend the 178th ASA meeting in San Diego, CA, December 2-6, 2019, and will receive financial assistance to help defray the cost of travel.

I regularly judge various scientific and technology programs. However, judging the ISEF event, as I have done a couple of times earlier, is by far my favorite, considering the young age and passion for mastering their areas of interest that these high-school students demonstrate. The students are highly motivated to observe, learn, and innovate, and their in-person interviews provide a rare insight into their confidence and curiosity. The event this year, compared with the event in Phoenix (2016), was striking in the competitors' adeptness in using easily accessible computational tools, cloud computing, machine learning, and artificial intelligence. It is also impressive how the ASA judging group comes together, bringing interdisciplinary thinking to achieve consensus. In terms of validation of the project choices of the ASA-SAO that were picked for recognition, all three prize-winning projects received additional category or special prizes. For ASA colleagues who are interested in learning about a wide array of scientific areas, judging at ISEF would be well worth the 2- to 3-day effort it takes to participate. More information about judging at future ISEF events can be obtained by contacting the ASA education coordinator (kjones@acousticalsociety.org).

References

Vipperman, J. (2018). Acoustical Society of America at the 2018 Intel International Science and Engineering Fair. *Acoustics Today*, 14(4), 66-68. https://doi.org/10.1121/AT.2018.14.4.66.

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