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Editorial

2022 NIEHS Catalytic Workshop Series on the Exposome

The exposome at NIEHS: from workshops to manuscripts

The Summer of 2022 can be remembered as a time when society was starting to see the benefits of the widespread use of novel vaccines to COVID-19. Based upon Nobel Prize-winning technology, the scientific achievement helped restore a sense of normalcy to the research enterprise. It was also notable for a workshop series hosted by the National Institute of Environmental Health Sciences (NIEHS) entitled "Accelerating Precision Environmental Health: Demonstrating the Value of the Exposome." The series was the brainchild of NIEHS Director Dr. Richard Woychik not long after he had taken the reigns of the Institute at the height of the pandemic. He was intrigued by the exposome concept and wanted to gather input from the scientific community. The catalytic workshop series was open to the public, spanned five interactive virtual workshops held in July and August of 2022, and culminated in a virtual summit in September 2022.

Dr. David Balshaw, Director of Extramural Research and Training, and Dr. Yuxia Cui, Health Scientist Administrator in the Exposure, Response, and Technology Branch had overseen much of the exposome-related work at the Institute and helped design the event with input from an organizing committee that consisted of experts from multiple scientific disciplines. Dr. L. Michelle Bennett, formerly Director of the NIEHS Office of Science Innovation, helped facilitate the discussions and set a high bar for innovation and creativity. Michael Herman, a strategic consultant who facilitates Open Space meetings, orchestrated a range of virtual sticky note activities, whiteboarding exercises, and breakout room discussions. The Open Space format is designed to avoid *a priori* assumptions and decision-making by maximizing input in the meeting design and execution from a wide range of stakeholders. This format invites all participants to share their ideas, visualize everything relevant to the topic at hand, and to commit to delivering results and learning together.

Five themes were developed by the organizing committee and the participants helped expand them for the meeting discussions: Tools, Technologies, and Methodologies; Biological Responses and Impact on Health and Disease; Future of Clinical and Prevention Trials, Cohorts and Epidemiology; Social and Societal Impacts; and Data Infrastructure and Data Analytics.[1]

With over 400 registered participants the workshop series was an unquestionable success. A single workshop report would not be able to do justice to the numerous rich discussions that occurred. Thus, the planning committee commissioned teams from the workshop participants to write manuscripts that reflected the content of the meetings and were based on the aforementioned themes. The teams drafted and revised manuscripts that were then submitted to *Exposome*.[2]

What you will see in the pages of *Exposome* (see titles below) are the results of the months of discussions, debate, writing, and revising. To allow those who participated in the discussions to get credit for their effort even though they were not on the writing teams, we created a consortium authorship model. Officials at NIEHS sent all the attendees an invitation to be signatories to "The Exposome Consortium." Participants were able to select the manuscripts they wanted to be part of by being a member of "The Exposomics Consortium" for each specific paper. The consortium list is customized for each of the manuscripts, such that if a person didn't think they contributed to a particular manuscript they would not be included. Indeed, participants had to opt-in for each manuscript on which they were affiliated. Privacy and consent were priorities for the consortium. Care was taken to ensure that the data transmission, storage, and handling were secure using Secure Socket Layer technology to encrypt all communication with participants. The website uses secure authentication and is GDPR compliant.

Thus, when you see "The Exposomics Consortium" listed as a co-author, it reflects the community who had an interest and time to be part of the workshop series. The goal was to be inclusive just like the Open Space meeting structure. Of course, some exposome enthusiasts may not have been able to participate in the workshop series, and we encourage them to become engaged in future endeavors which are certain to occur. It is also possible that some attendees did not register and opt-in for inclusion and are, therefore, not listed. NIEHS sent reminders, but if anybody was inadvertently left out, we apologize. We foresee many opportunities for derivatives of the "The Exposomics Consortium" to be used in future efforts and encourage interested parties to visit the website often (https://www.exposomicsconsortium.org/). The participation list is fully customizable and linked to a specific URL of record. We anticipate that the model can be used for future community efforts, which aligns with the spirit of an emerging field that requires the coordinated participation of an actively engaged community.

The following papers from the Summer 2022 Workshop Series "Accelerating Precision Environmental Health: Demonstrating the Value of the Exposome" will appear in *Exposome*:

Stingone J, Geller A, Hood D, Makris K, Mouton C, States J, Sumner S, Wu KL. Rajasekar A, and Members of The Exposomics Consortium. Community-level exposomics: A population-centered approach to address public health concerns.

Rajasekar A, Miller GW, Motsinger-Reif A, Cui Y, Overdahl K, Jarmusch A, Walker D, Rushing B, Juarez P, Ramesh A, Mouton C, Soliman G, Chung MK, Habre R, and Members of The

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Exposomics Consortium. Establishing a community of practice for exposomics.

Sumner S, Rushing B, Thessen A, Soliman G, Ramesh A, and Members of The Exposomics Consortium. The exposome and nutritional pharmacology and toxicology: a new application for metabolomics.

Schmitt, Charles; Stingone, Jeanette; Rajasekar, Arcot; Cui, Yuxia; Du, Xiuxia; Duncan, Chris; Heacock, Michelle; Hu, Hui; Gonzalez, Juan; Juarez, Paul; Smirnov, Alex; and Members of The Exposomics Consortium. A roadmap to advance exposomics through federation of data.

Wright R, Makris K, Natsiavas P, Fennell T, Rushing B, Wilson A, and Members of The Exposomics Consortium. A long and winding road: culture change on data sharing in exposomics.

Patel C, Chung MK, House J, Akhtari F, Makris K, Langston M, Islam K, Holmes P, Chadeau-Hyam M, Smirnov A, Du X, Thessen A, Cui Y, Zhang, K Manrai A, Motsinger-Reif A, and Members of The Exposomics Consortium. Data science concepts and considerations in conducting and interpreting exposome-wide association studies.

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Author contributions

Gary W. Miller (Writing—original draft [equal])

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2. Miller GW. Exposome: a new field, a new journal. Exposome 2021;1(1):1–2.