

Report 58: Develop novel technologies and methodologies to detect and analyze (real-time) multiple exposures and their human health effects

Convener: Stavros Garantziotis

Brief History:

Multiple exposures are the reality in human biology. However, we do not really know what we are exposed to in daily life. We need to have accurate information on the multitude of exposures that may in aggregate affect human biology and development, even though they may be innocuous when viewed in isolation. The NIEHS has already developed an Exposure Biology Program which is piloting multi-exposure sensors. This panel would like to expand on this program in order to address the next generation of environmental exposure questions.

Discussion Highlights:

1. Exposures may be vastly different depending on geographic location and period of life
2. Real-time sensing is important for short-term exposure effects, but usually not as important for long-term effects (exceptions apply). Integrated exposures are sufficient for the latter. Technology for this may be more feasible.
3. Non-real-time exposures should therefore be the initial target of a development effort
4. Strategy will need to be guided by first attacking problems which have a finite exposure-effect window (e.g. prenatal/postnatal exposures on childhood development)
5. Understanding of biology will inform sensor development, but hypothesis-building data mining is also very valuable. In all, this will need to be an iterative process with a mix of biology-driven targeted sensing of specific toxicants, and non-targeted sampling of data.
6. Existing databases (such as NHANES) can be used to mine biomarkers of exposure, so that sensor development can be strategically guided to target the environmental toxicants associated with these biomarkers
7. Statistics and IT tools are currently available to handle the mass of data likely to result. Therefore, from the development perspective this seems to be more of an engineering problem.
8. Cross-pollination and interaction between disciplines (engineers, biologists, biostatisticians etc.) needs to be fostered.
9. Research initiatives need to be designed so that multiple questions can be answered with similar approaches, and that follow-up projects can be developed.

Recommendations:

1. Identify next generation of questions that are not answerable with currently available technologies and would be answerable within reasonable period of time.
2. Try to find combinations of problem areas and platforms that may be answered with similar technology
3. Panel identified child development issues as such an example (e.g. autism, childhood asthma), but other mechanisms such as RFI can be used to develop set of targets
4. Develop cross-discipline teams to design best approach (e.g. based on best knowledge of biology, available technology, etc.)
5. Promote process of refinement of pilot systems
6. Build upon existing Exposure Biology Program expertise and experience

Discussion Participants: Archer, Balshaw, Bird, Fargo, Fasman, Garantziotis, Nicholas, Serabjit-Singh, Weinberg, others on drop-in/out basis.