Report 71: Environmental pressures over space and time—taking advantage of novel technologies

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Brief History:

Compared to other biomedical fields, environmental health deals with complex spatial and temporal components to link exposure to outcomes. Technologies to evaluate space and time dimensions of the environment, such as remote sensing datasets, are currently being underutilized and are particularly important for looking at environmental aspects of complex diseases, health impacts of climate change, and health disparities. On longer time scales, evolutionary approaches to tease apart adaptive responses to the environment are key to understanding gene-environment interactions (i.e. environmental pressures on previous generations shape the genomes, behaviors and hence health outcomes today) and predictions for limits of adaptation to climate change. In 2005, NIEHS convened a workshop on global earth observations applications to air quality and human health, and findings from this workshop could serve as a basis for expanding this topic further.

Discussion Highlights:

Particularly for epidemiological studies, geospatial datasets are key to understanding composite exposures. Spatial data architectures can provide environmental exposure estimates through integration of census, land use, hydrology, community resources, health care access, green space, built environment, crime, air pollution, water quality, product purchasing demographics—when cohorts are geo-referenced relationships can be tested. This will be particularly useful for integration with medical records datasets. Evolutionary biology is particularly important for looking at environmental justice and health disparities research. For example racial differences in vasculature may be explained by environmental conditions at locations of origin. GIS datasets are particularly useful for determining disproportionate exposures across communities and relevant for environmental justice. EWAS studies will be able to use these technologies. In terms of climate change and health, studies of relative fitness across temperature and hydrological parameters across different model species will be useful for establishing estimates for limits and mechanisms of adaptation.

Recommendations:

1. Explore the possibility of joint RFAs or programs with NASA and/or NSF using remote sensing and evolutionary biology to answer environmental health questions.

2. Leverage resources in CTSAs by enhancing with environmental datasets—linking medical records will provide spatially referenced cohorts to examine environmental health questions.

3. NIEHS should develop intramural and extramural programs in GIS, remote sensing, and spatial statistics.

4. Develop spatial data architecture on a regional basis (e.g. pick one state from NE, mid-Atlantic, Deep South, Mid-West, SW etc.) to explore differences in exposures—this is particularly relevant for health disparities and climate change research programs.

5. Prioritize mixtures exposures most relevant for testing by NTP via use of spatial data architecture outputs.

6. **Support research in ecologically relevant model systems to look at time/space interactions over multiple generations to determine evolutionary pressures.**

Discussion Participants:

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