

**Priority Topic 2:** Connecting environmental influences to disease through the study of epigenomics and epigenetic mechanisms

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**Discussion Participants:** Bernstein, Dolinoy, Gilliland, Hall, Hanawalt, Hollingsworth, Kemp, McAllister, Taylor, Worth

**Subtopic Report Numbers from Days One and Two:**

3 Moving beyond the conventional notion of 'bad' substances causing disease while 'safe' substances do not.

12 Early Life Exposure(periconceptual through adolescence) leading to later life impacts

18 Acquired DNA modification(both DNA sequence and epigenetic modifications) may provide an integrated dosimeter of environmental exposure and be a useful predictor of disease

22 Research translation/communication

24 Nutritional modulation of environmental insults (or interplay of nutrients with toxicants to modulate health and disease)

31 Healthy buildings and communities

34 Commensal Organisms (Microbiome) and Health

36 Role of environment in neurodegenerative disease and healthy aging

40 Environmental Epigenomics

41 Partnering with communities

46 Appropriate reporting and analysis of sex differences in environmental research

49 Children's Environmental Health Research; networks and more bang for the buck

70 The role(s) of ncRNAs in environmental health

79 Exposure science and exposome

81 Environmental epigenomics and complex heritable disease

94 Toxicants as potential metabolic disruptors

**Recommended Strategic Goal:**

***Connecting environmental influences to disease through the study of epigenomics and epigenetic mechanisms is an opportunity and important overarching goal for NIEHS.***

ENVIRONMENT → EPIGENOME (+GENETICS) → MANIFESTATION OF DISEASE

NIEHS should be a leader in the field of acquired genetic/epigenetic changes from exposure and diet across the lifecourse. A broad goal is to link patterns of epigenomic modifications to environmental exposures. This represents a key step towards (i) linking environment to disease and susceptibility; (ii) attaining mechanistic insight into the underlying pathophysiology; and (iii) identifying biomarkers that quantify exposure and could be combined with genetic information to predict disease risk. These areas have enormous opportunity for human health given the potential reversibility of epigenomic changes by targeted therapeutics.

A number of key areas and opportunities were identified in this regard.

- Systematic study of epigenomic changes induced by specific environmental exposures in multiple contexts, including stem cell models, model organisms and human populations.
- Technology development to enable environmental epigenomics.
- Increase understanding of the stability and plasticity of specific types of epigenomic changes.
- Understanding interactions between genetics, epigenomics and environment.
- Careful consideration of vulnerable windows of susceptibility to the environment and their relationship to epigenome (trans-generational, *in utero*, chronic, etc.).

**Potential Beneficiaries of this Strategic Goal:**

Potential outcomes of this effort include improved biomarkers, strategies for intervention/prevention, risk assessment, early detection, and basic mechanistic understanding of human biology.

**NIEHS Capabilities and Partnerships Needed to Achieve this Goal:**

NTP, DIR, DERT, NHGRI, Common Fund Epigenomics, International Human Epigenome Consortium, Biotech/Pharma target epigenome