Science Policy Council

INTERIM POLICY ON GENOMICS

Background

The Environmental Protection Agency (EPA) is aware of the rapidly advancing field of genomics since completion of the initial sequencing of the human genome. EPA expects that genomics data may be received as supporting information for various assessment and regulatory purposes, e.g., identifying an environmental stressor's mode or mechanism of action. Genomic research tools now permit the study of gene and protein expression changes in various organisms and their cells, or tissues, with specificity to the level of molecular function. While genomics offers the opportunity to understand how an organism responds at the gene expression level to stressors in the environment, understanding of such molecular events with respect to adverse human or ecological health outcomes is far from established. Understanding these relationships becomes increasingly more complex as the number of sequenced genomes for an ever increasing variety of organisms becomes available. Thus, there is a need for the Agency to provide an interim policy on the current interpretation and utility of genomics data in the context of risk assessment and risk management and the implications this has for EPA's infrastructure needs.

Genomics approaches have the long term promise to aid in the understanding of an organism's response to stressors and to guide the selection of informative bioindicators for monitoring the impact of stressors on human and ecological health. Thus, EPA believes that genomics will have an enormous impact on our ability to assess the risk from exposure to stressors and ultimately to improve our risk assessments.

Science Policy Council's Interim Position

EPA believes that genomic data and analyses will significantly impact many areas of scientific research and human and ecological health assessments. Genomics data may allow EPA to enhance its assessments and better inform the decision-making process. Accordingly, EPA must understand how to develop and use the research tools made possible from genomics and understand the appropriate uses of genomics data to inform Agency decisions. For EPA, the term "genomics" encompasses a broader scope of scientific inquiry and associated technologies than when genomics was initially considered. A genome is the sum total of all an individual organism's genes. Thus, genomics is the study of all the genes of a cell, or tissue, at the DNA (genotype), mRNA (transcriptome), or protein (proteome) levels.

Genomics methodologies are expected to provide valuable insights for evaluating how environmental stressors affect cellular/tissue functions and how changes in gene expression may relate to adverse effects. However, the relationships between changes in gene expression and adverse effects are unclear at this time and may likely be difficult to elucidate. Nonetheless, EPA believes that some of these changes may prove to be predictive of subsequent adverse effects. Changes in gene expression can be informative when a weight-of-evidence approach for human and ecological health assessments is performed, particularly when used to explore the possible link between exposure, mechanism(s) of action, and adverse effects. In addition, genomics information may be useful to EPA in setting priorities, in ranking of chemicals for further testing, and in supporting possible regulatory actions. While genomics data may be considered in decision-making at this time, these data alone are insufficient as a basis for decisions. For assessment purposes, EPA will consider genomics information on a case-by-case basis. Before

such information can be accepted and used, agency review will be needed to determine adequacy regarding the quality, representativeness, and reproducibility of the data.

EPA believes that genomics will ultimately improve the quality of information used in the risk assessment process. For example, genomics shows promise to identify variability and susceptibilities in individuals from exposed populations or among different species. It will also likely provide a better understanding of the mechanism or mode of action of a stressor and thus assist in predictive toxicology, in the screening of stressors, and in the design of monitoring activities and exposure studies. Application of genomics methodologies may help reduce or eliminate traditional types of toxicity testing as well as improve the scientific rationale for when such testing is needed. Genomic analysis also holds promise to evaluate the cumulative impacts resulting from the interplay of factors such as genetic diversity, health status, and life stage in responding to exposure(s) to multiple stressors.

EPA encourages further research on methods development, methods evaluation, and data collection to address existing gaps in knowledge concerning the consequences of genomic changes. EPA's goal is to develop knowledge that will ultimately reduce the uncertainties in the assessment of hazard, exposure, and risk from stressors. In parallel with data generation, there is an equal need for developing information technologies, for research on the analysis of data, and for applications of genomics data in computational toxicology. As EPA gains experience in applying genomics information and refines its understanding of the use of such information, it will develop guidance to explain how genomics data can be better utilized in informing decision-making and related ethical, legal, and social implications. EPA is working with other Federal, state, and Tribal organizations, as well as with academic, international, and industry groups to

facilitate scientifically sound applications of genomics data. In addition, EPA will continue to build partnerships and communicate with all interested stakeholders as an essential component of the Agency's future activities in genomics.