

**Report 35:** Moving from the “cure” model to the three “P” ---Predicting, Preventing, Personalized treatment of autoimmune diseases and Cancer

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**Brief History:** With the human genome project there is now a platform for identifying biomarkers, studying epigenetics and the potential for personalized treatments. Focusing on the three “P” will engage the public more and lessen the frustration with the lack of promised “Cures.”

Although many gene variants are linked to autoimmune diseases, each contributes just a small percentage of overall risk. Disease occurs when many genes act together and even then genetics can't explain the entire risk, indicating that environmental factors are involved to a significant degree. The concordance of autoimmune disease in identical twins is at most 30-50%.

**Discussion Highlights:**

- There is a need to identify environmental triggers of autoimmune disease by expanding the realms of possible triggers to more than chemical. Other triggers, which should be explored are supposed “safe” substances, stress, hormone, viruses/infections, allergens, diet or even a too clean, parasite free gut environment.
- It is not known what role epigenetics or the microbiome play in the development of autoimmune diseases.
- Why is there a common genetic background but different expression of autoimmune diseases?
- There is a lack of consolidated efforts to coordinate and understand the mechanisms involved in autoimmune diseases and immune mediated inflammatory conditions. Understanding mechanisms may help to focus on targeted treatments.
- Understanding the timing of triggering events during development in multiple autoimmune diseases and cancer is an important research area for NIEHS to consider.
- Autoimmune and inflammatory immune mediated diseases are increasing significantly in the developed world and it is not known what synergistic interactions among environmental factors and disease are at play.
- Only 24 of the more than 130 autoimmune diseases have a good epidemiology study and this inhibits the understanding of the magnitude of the problem and makes health policy development difficult.

**Recommendations:**

- Epidemiology studies on autoimmune diseases for which there is none.
- Increased collaboration and consolidation among the NIEHS and the other NIH institutes studying biomarkers, epigenetics, microbiome and environmental triggers of autoimmune diseases and cancer.
- Given that environmental factors are a major component in the development of autoimmune diseases, NIEHS should be the lead Institute in the coordinating the research efforts for autoimmune diseases.
- NIEHS should take a leadership role in studying the full range of potential interactions between diseases (cancer, autoimmune disease, etc.) and the much wider Range of environmental triggers than is currently studied.
- Considerable more research into the mechanisms involved in the development of autoimmune diseases and immune-mediated inflammation and how the environment plays a role.
- Understanding the environmental exposures during development (pre- and postnatal) is key to understanding the common links to shared genetic loci among different autoimmune diseases. There is a need to better understanding of why these diseases cluster in families and can manifest as different autoimmune diseases in identical twins.
- More research into the early life exposure to environmental elements and the role of genetic background in the development of autoimmune diseases.
- Better data documenting the frequency and location of autoimmune diseases in the population. Example: a national registry that would allow for tracking disease hot spots and environmental exposures.
- NIEHS should study the synergistic interactions among environmental factors and disease. Example: radon and cigarette smoking individually can trigger cancer; exposure to the combination synergistically increases cancer risk.
- More research into the role of infections, hormone disruptors, stress, and diet should be study as environmental triggers of autoimmune diseases.
- Using a systems based approach to understand differential host responses to environmental exposures is needed.

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