

Transcript: NIEHS GEH DOHAD Podcast

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**Narrator:** This is Global Environmental Health chat, the podcast that explores environmental health issues that transcend national boundaries. This podcast is produced by the National Institute of Environmental Health Sciences.

In the field of study referred to as the developmental origins of health and disease (DOHaD), scientists are finding evidence that environmental factors during early development can lead to negative health effects throughout life and sometimes through future generations.

Dr. Jerry Heindel is a program administrator who has worked to develop DOHaD at NIEHS. He explains DOHaD as the study of any environmental factor that changes developmental programming in a way that increases susceptibility to disease later in life. Lifestyle factors, existing diseases, stress, nutrition, or exposure to environmental chemicals can all have a role in DOHaD.

**Jerry Heindel:** DOHAD stands for the developmental origins of health and disease. It's a paradigm that says it doesn't matter when diseases show up across the lifespan, that the disease is actually initiated or the susceptibility to the disease is started during development when the tissues are forming.

**Narrator:** The Barker Hypothesis, set forth in 1990, proposed that low birthweight or premature birth had a causal relationship with the origins of metabolic and cardiovascular disease in adults. As scientists began to explore the linkages between early life and disease, the terminology evolved. The Barker Hypothesis became known as the "fetal basis of adult disease", and then "developmental origins of disease" to reflect the susceptibility to diseases throughout the life course rather than just in adulthood. Today we use the term DOHaD.

**Jerry Heindel:** It was changed to the developmental origins of health and disease, indicating that development is a time when you can have increased susceptibility to disease, but it's also a time when you can reduce susceptibility to disease and increase health across the lifespan.

**Narrator:** NIEHS has been at the forefront of DOHaD research, beginning with the study of chemicals that caused severe birth defects. NIEHS launched three key initiatives in DOHaD research that propelled the field forward, and stimulated research in new fields of study. The first was funding research on endocrine disrupting chemicals. The second was in response to new technology which allowed researchers to investigate molecular level effects and disease outcomes later in life. The results from those studies showed that modifications to how genes work, called epigenetic changes, play an important role in DOHaD. As a result, the third NIEHS initiative was to fund epigenetic studies.

**Jerry Heindel:** So it's been a continuum of looking at where the field is going and putting out new initiatives to continue to stimulate the field over the last 20 or more years." Those three initiatives over 10 years or so really drove this whole field of developmental origins of health and disease, and today that field is continuing to grow.

**Narrator:** NIEHS is a global leader in supporting DOHaD research and is coordinating studies around the world in its role as a WHO Collaborating Center.

While the global burden of disease has shifted to mostly non-communicable diseases, such as diabetes, cardiovascular disease, and metabolic syndrome, the vast majority of these deaths occur in low and middle income countries which tend to have higher levels of environmental exposures.

Dr. Mark Hanson is one of the UK's leading researchers on developmental pathways to disease, and a founding member and current President of the International Society for DOHaD.

**Mark Hanson:** Non-communicable diseases kill more than two-thirds of the population of the world. 80 percent of those deaths sadly occur in low to middle income countries. And so this is just a humanitarian tragedy, and there's absolutely no reason why we should tolerate it. So the question relates to why this has come up on us so rapidly and why in particular in low and middle income countries.

**Narrator:** The DOHaD paradigm helps explain this dramatic increase. It is now well established that genes, lifestyle, and environmental factors in early life or other windows of susceptibility, can influence disease risk. If we think about early development, some of these important factors include parental nutrition, whether the parents are obese or overweight, how stressed they are, if they smoke, and whether they are exposed to environmental toxins.

**Mark Hanson:** All these aspects of the developmental environment have changed very dramatically over the last couple of decades, and they perhaps change faster in developing countries than anywhere else. The other thing, sadly, is that we now know that there's a very clear transgenerational transmission of disease so that the individual who has, for example, obesity and diabetes, is much more likely to pass on that risk to the next generations.

**Narrator:** Another important factor is the concept of 'mismatch'. During fetal development, cues from the mother are used to "predict" the baby's future environment. For example, if the fetus "predicts" that food will be scarce, its metabolism may develop in a way that seeks to conserve energy and resources. When the prediction does not align with reality, we call this a mismatch.

**Mark Hanson:** The trouble is that the prediction over the last couple of decades has turned out to be terribly wrong, and that's going to increase the risk of disease. So the combination of changes during development which have set up a phenotypic response, and an environment that is now very unhealthy from childhood onwards are two of the things that have contributed to the real epidemic of these diseases.

**Narrator:** Environmental factors in early in life clearly influence disease risk, but let's get back to Jerry's point about this also being a time when you can reduce susceptibility to disease and increase health. Scientists are exploring novel biomarkers, which can be measured in the human body, and can indicate exposure to chemicals or early signs of disease. These biomarkers may allow people to alter their lifestyles to reduce exposures before long term health problems occur.

Finally, there is a new global emphasis on recognizing the influence of environmental factors on human health and taking action to improve disease outcomes. For example, in 2015 the Secretary General of the United Nations announced new Sustainable Development Goals. These goals emphasize the interaction of the environment and development on human health. That same year, he launched the Global Strategy for Women's, Children's, and Adolescent's Health, which stressed the economic benefits of early environmental interventions and education.

These global initiatives -along with innovative research supported by agencies such as WHO and NIEHS- will continue to improve our understanding of critical windows of development and disease while advancing goals of sustainable development, education, and interventions to improve public health.

You can learn more about DOHaD by visiting our website at [www.niehs.nih.gov/GEH](http://www.niehs.nih.gov/GEH). Thanks again to Dr. Jerry Heindel and Dr. Mark Hanson for joining us today. You've been listening to Global Environmental Health Chat, brought to you by the Global Environmental Health program of the National Institute of Environmental Health Sciences.

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