

## Science Spotlight

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# Researchers from NIEHS and International Cohort Collaborate to Study Early-Life Exposures

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At NIEHS, researchers from the Epidemiology Branch are using biologic samples collected from pregnant Norwegian women to investigate how early-life exposure to environmental contaminants may affect adult health. The samples, which include cord blood, whole blood, plasma, and urine, were collected from women enrolled in the [Norwegian Mother and Child Cohort Study](#), or MoBa, an ongoing, long-term prospective cohort study of pregnant Norwegian women and their children. NIEHS epidemiologists are analyzing these samples to measure the level of exposure to environmental contaminants in relation to a range of health endpoints, such as obesity and asthma, among the pregnant women and their children.



*NIEHS epidemiologists are collaborating with scientists from the Norwegian Mother and Child Cohort Study to explore how exposure to environmental contaminants in early life may affect adult health.*

A growing body of evidence suggests that disease and poor adult health may originate during fetal development and early childhood. This concept, called the [Developmental Origins of Health and Disease \(DOHaD\)](#) hypothesis, posits that early life environmental exposures can alter development in a way that leads to disease later in life. In its role as a World Health Organization collaborating center, NIEHS is promoting global awareness of the DOHaD concept and supporting research to increase the knowledge of how certain diseases may originate during critical windows of development. Supporting international birth cohorts like MoBa is one way NIEHS is building understanding of DOHaD on the global scale. Between 1999 and 2008, epidemiologists at the Norwegian Institute of Public Health enrolled more than 100,000 pregnant women in the MoBa cohort. During this period, they collected exposure and health data on the babies, mothers, and fathers. Using a series of questionnaires, the researchers continue to follow up with the families. The study's overall goal is to find the causes of serious diseases among the mothers and their children due to environmental exposures. Since 2002, NIEHS has supported this goal by funding the collection of additional biologic samples that are being used to help identify the environmental contaminants that may contribute to disease.

According to NIEHS epidemiologist [Matt Longnecker, M.D., Sc.D.](#), having access to this large cohort and substantial collection of biologic samples allows NIEHS scientists to prospectively examine the relationship between levels of environmental contaminants and health later in life. "Our MoBa-based

studies tie into the idea that exposures in early life can be an important determinant of adult health,” he explained.

More than ten NIEHS scientists are involved in different [MoBa-based studies](#). For example, Longnecker is examining the association between blood levels of [perfluorinated chemicals](#) in MoBa mothers during pregnancy and a range of health outcomes that include [lipid levels during pregnancy](#), [birth weight](#), [preeclampsia](#), child growth, and childhood obesity. He also collaborated with Norwegian researchers to investigate how *in utero* exposure to maternal tobacco smoke affects metabolic outcomes among adult women. The research team he worked with found that pregnant women enrolled in MoBa who were exposed to maternal tobacco smoke *in utero* were more likely to be obese, have high blood pressure, and develop gestational diabetes mellitus during pregnancy than were women who were not exposed.

NIEHS epidemiologist [Stephanie London, M.D., Dr.P.H.](#), also teamed up with researchers from Norway to better understand the mechanisms by which *in utero* exposure to maternal tobacco smoke affects the baby’s health. London and colleagues provided strong evidence that epigenetic changes — the heritable marks that regulate gene expression without altering DNA sequence — may underlie some of the well-documented health impacts in children whose mothers smoke during pregnancy. Moving forward, London continues to collaborate with investigators in Norway to study how early-life exposures may contribute to the development of asthma and allergies. She is currently using questionnaires to identify MoBa children who developed asthma and allergies by age seven.

Longnecker is working with Stephanie Engel, Ph.D., an epidemiologist from the University of North Carolina at Chapel Hill, who is using maternal urine samples from MoBa to investigate the relationship between *in utero* exposure to phthalates and organophosphate pesticides and attention deficit/hyperactivity disorder in early childhood.

According to Longnecker, MoBa has created many exciting research opportunities to explore how the environmental factors we encounter in early life can be important to adult health. “MoBa samples give us access to data about environmental exposures that took place long before disease occurs,” he explained.

#### **Selected Publications from the MoBa Cohort**

[Cupul-Uicab LA, Skjaerven R, Haug K, Melve KK, Engel SM, Longnecker MP](#). 2012. In utero exposure to maternal tobacco smoke and subsequent obesity, hypertension, and gestational diabetes among women in the MoBa cohort. *Environ Health Perspect* 120(3): 355-360.

[Joubert BR, Håberg SE, Nilsen RM, Wang X, Vollset SE, Murphy SK, Huang Z, Hoyo C, Middtun Ø, Cupul-Uicab LA, Ueland PM, Wu MC, Nystad W, Bell DA, Peddada SD, London SJ](#). 2012. 450K epigenome-wide scan identifies differential DNA methylation in newborns related to maternal smoking during pregnancy. *Environ Health Perspect* 120(10):1425-1431.

[Starling AP, Engel SM, Whitworth KW, Richardson DB, Stuebe AM, Daniels JL, Haug LS, Eggesbø M, Becher G, Sabaredzovic A, Thomsen C, Wilson RE, Travlos GS, Hoppin JA, Baird DD, Longnecker MP](#). 2014.

Perfluoroalkyl substances and lipid concentrations in plasma during pregnancy among women in the Norwegian Mother and Child Cohort Study. *Environ Int* 62:104-112.

[Starling AP, Engel SM, Richardson DB, Baird DD, Haug LS, Stuebe AM, Klungsøyr K, Harmon O, Becher G, Thomsen C, Sabaredzovic A, Eggesbø M, Hoppin JA, Travlos GS, Wilson RE, Trogstad LI, Magnus P, Longnecker MP. 2014. Perfluoroalkyl substances during pregnancy and validated preeclampsia among nulliparous women in the Norwegian Mother and Child Cohort Study. Am J Epidemiol 179\(7\):824-833.](#)

[Whitworth KW, Haug LS, Baird DD, Becher G, Hoppin JA, Skjaerven R, Thomsen C, Eggesbø M, Travlos G, Wilson R, Cupul-Uicab LA, Brantsaeter AL, Longnecker MP. 2012. Perfluorinated compounds in relation to birth weight in the Norwegian Mother and Child Cohort Study. Am J Epidemiol 175\(12\): 1209-1216.](#)