

## Extramural papers of the month

By Nancy Lamontagne

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Superfund Research Program  
Research Brief. New issues  
are published on the first  
Wednesday of each month.

### Teeth analysis reveals early-life dietary transitions

NIEHS-supported researchers report that the ratio of barium to calcium in teeth can accurately reflect an infant's dietary transition from the introduction of mother's milk through weaning. This work identifies a new biomarker that could be useful for epidemiologic investigations of the health consequences of breastfeeding and chemical exposures during early life, and for determining developmental transitions in primates.

The researchers investigated the spatial distribution of barium and calcium in teeth, using laser ablation-inductively coupled plasma-mass spectrometry for high-resolution elemental analysis. They analyzed teeth from macaques with known diet histories, as well as teeth shed by children enrolled in the Center for the Health Assessment of Mothers and Children of Salinas (CHAMACOS) study,

(<http://cerch.org/research-programs/chamacos/>)

at the University of California, Berkeley, where breastfeeding and infant formula use were prospectively recorded. The analyses showed that the ratio of barium to calcium in teeth reflected the barium intake via mother's milk, and could be used to determine the exact timing of birth, when the infant was fed exclusively on mother's milk, and the weaning process. The researchers also documented the first early-life dietary transition in a juvenile Neanderthal, by applying the technique to a several-thousand-year-old Neanderthal tooth.

*Citation:* Austin C, Smith TM, Bradman A, Hinde K, Joannes-Boyau R, Bishop D, Hare DJ, Doble P, Eskenazi B, Arora M.

(<http://www.ncbi.nlm.nih.gov/pubmed/23698370>)

2013. Barium distributions in teeth reveal early-life dietary transitions in primates. *Nature* 498(7453):216-219. [Story](#)

### Nano GO Consortium studies health effects of nanoparticles

Researchers from institutions that are part of the NIEHS-funded Nano GO Consortium used mouse and rat models to examine pulmonary health effects related to titanium dioxide nanoparticles and carbon nanotube exposure. Predictable and repeatable results from multiple institutions is important for informing policies that prevent possible health risks associated with nanomaterials, and the research demonstrated that the multicenter consortium approach can provide comparable data across institutions.

Using a standard protocol across multiple labs, researchers examined three forms of titanium dioxide (TiO<sub>2</sub>) nanoparticles and three forms of multiwalled carbon nanotubes. Four laboratories evaluated lung responses to nanomaterial exposure in mice, and three labs evaluated lung responses in rats. At day one, all three types of titanium dioxide nanoparticles caused significant inflammation in mice in three of four labs. For the rat studies, anatase nanobelts (TiO<sub>2</sub>-NB) caused inflammation in rats at day one in two of three labs, while anatase/rutile spheres (TiO<sub>2</sub>-P25) and anatase spheres (TiO<sub>2</sub>-A) had no significant effect for any of the labs. TiO<sub>2</sub>-induced inflammation in both mice and rats resolved after seven days. Original and purified multiwalled carbon nanotubes, as well as carbon nanotubes functionalized with carboxylic acid, all caused inflammation at day one in mice in three of four labs, and in rats in all three labs. The researchers say that future research using this consortium approach for toxicity testing and exposure assessment would help ensure the safe continuation and economic viability of nanotechnology.

*Citation:* Bonner JC, Silva RM, Taylor AJ, Brown JM, Hilderbrand SC, Castranova V, Porter D, Elder A, Oberdörster G, Harkema JR, Bramble LA, Kavanagh TJ, Botta D, Nel A, Pinkerton KE.

(<http://www.ncbi.nlm.nih.gov/pubmed/23649427>)

2013. Interlaboratory evaluation of rodent pulmonary responses to engineered nanomaterials: the NIEHS Nano GO Consortium. *Environ Health Perspect*; 121(6):676-682.

### Prenatal BPA exposure alters brain function and behavior in mice

A study, supported in part by NIEHS, found that low-dose prenatal bisphenol A (BPA) exposure in mice brought about lasting

epigenetic changes in the brain. These changes were sex specific and associated with alterations in social and anxiety-like behavior.

The researchers exposed pregnant mice to BPA at doses of 2, 20, or 200 micrograms per kilogram a day. They then looked at how this exposure affected gene expression, DNA methylation, and social and anxiety-like behavior of the offspring. They found that these doses of BPA induced changes in expression of genes encoding estrogen receptors and estrogen-related receptors in the offspring. The BPA effects were sex-specific, dose-dependent, and brain region-specific. BPA exposure was also associated with sex-specific effects on social and anxiety-like behaviors.

The researchers say that future studies of the timing and mechanisms of the BPA-related epigenetic disruption, as well as identification of the genes and signaling pathways that may be involved, will reveal more about the mechanisms that underlie the effects of prenatal BPA exposure on the brain.

**Citation:** Kundakovic M, Gudsnuk K, Franks B, Madrid J, Miller RL, Perera FP, Champagne FA.

(<http://www.ncbi.nlm.nih.gov/pubmed/23716699>)

2013. Sex-specific epigenetic disruption and behavioral changes following low-dose *in utero* bisphenol A exposure. Proc Natl Acad Sci U S A 110(24):9956-9961.

## **Dietary nicotine associated with lower Parkinson's disease risk**

A study, funded by NIEHS, found that people who consumed nicotine-containing vegetables, especially peppers, had a lower risk of developing Parkinson's disease. Previous studies have consistently shown an association between tobacco product use and a lower risk of Parkinson's disease, and the new study contributes additional evidence that nicotine may be responsible for tobacco's potentially protective effect.

The researchers studied 490 people with newly diagnosed Parkinson's disease, and 644 people who were neurologically normal. They compared the consumption of peppers, tomatoes, and potatoes, which all contain nicotine and are members of the same botanical family, *Solanaceae*, as tobacco. Parkinson's disease risk was reduced with increased frequency of consumption of these nicotine-containing vegetables (relative risk [RR] = 0.81, 95 percent confidence interval [CI] = 0.65-1.01 per time per day), but not for other vegetables (RR = 1.00, 95 percent CI = 0.92-1.10). They observed an inverse association for peppers specifically (ptrend = 0.005), and noted that the trend toward a lower Parkinson's disease risk was stronger when they examined edible *Solanaceae* by nicotine concentration (ptrend = 0.004), or focused on men and women who never used tobacco regularly. The researchers caution that their findings need to be confirmed and extended through additional studies, to better understand the relationship between *Solanaceae* phytochemicals and Parkinson's disease, and whether possible dietary or pharmaceutical interventions could lessen the risk.

**Citation:** Nielsen SS, Franklin GM, Longstreth WT, Swanson PD, Checkoway H.

(<http://www.ncbi.nlm.nih.gov/pubmed/23661325>)

2013. Nicotine from edible *Solanaceae* and risk of Parkinson disease. Ann Neurol; doi:10.1002/ana.23884 [Online 9 May 2013].

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