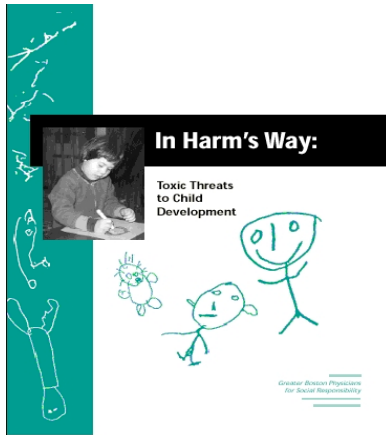


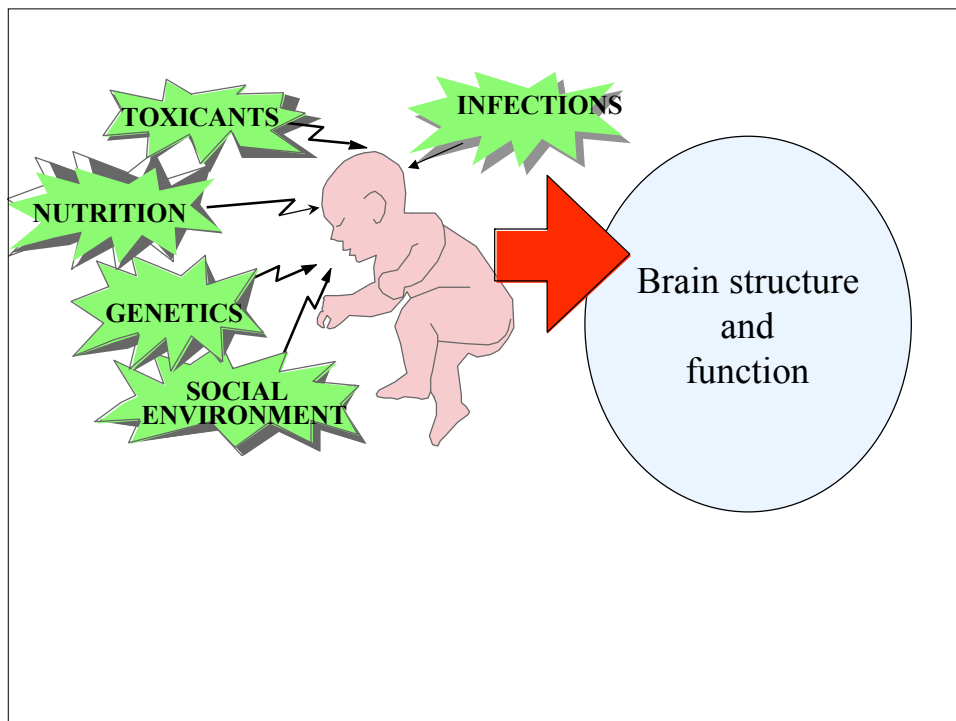
Nutrition and neurodevelopmental toxicants



Ted Schettler MD, MPH
Science and
Environmental Health
Network

www.sehn.org

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Nutrition and brain development

- Signs of malnutrition (zinc, protein, iron) at age 3 associated with hyperactivity, aggression, other behavioral disorders at ages 8-11; dose-response; controlled for other variables (Liu, Am J Psychiatry, 2004)
- Omega 3 and omega 6 FA supplements; improvement in reading, spelling, behavior in children with developmental coordination disorder (Richardson, Pediatrics, 2005)

Interactions: lead, iron deficiency, maternal diet

- Iron deficiency: 10% US toddlers, ↑ poverty, obesity; more common in developing countries
- Iron deficiency > cognitive impairment
- Iron deficiency and ADHD (53 cases, 27 controls; low ferritin 84% cases, 18% controls) (Konofal, Arch Pediatr Adolesc Med. 2004)
- Lead > cognitive impairment; other neurodevelopmental problems

Nutrition and lead absorption

- Lead absorption increased with:
 - Iron-deficient diet
 - Calcium-deficient diet
 - High fat diet

Intervention study

- 42 children (lead levels 25-54 ug/dl; mean 29 ug/dl; 18-30 mos of age; Bayley scales of infant development) ;
- Lead abatement and iron repletion where necessary; retested after 6 mos.
- No difference in their initial scores; only the iron sufficient children showed improvement in their scoring over 6 mos associated with decreased blood lead levels (Ruff, EHP, 1996)
- Several studies, but not all, show improvement in cognitive scores with iron supplements in iron deficient children—interactions with social factors.

Maternal diet, lead interactions: rodent studies

- Maternal omega 3 FA deficient diet and Pb exposure impair spatial learning
- An adequate FA diet AND lack of lead exposure are necessary for optimal spatial learning
- For olfactory learning, omega 3 FA deficient diet exacerbates the adverse effects of lead;
- But, adequate omega 3 FA alone does not prevent the strong adverse effect of Pb exposure

Fish consumption, mercury, and infant cognition

- Fish consumption during pregnancy improves cognitive performance at 18 mos of age
(Daniels, Epidem., 2004)
- Maternal fish consumption during pregnancy improves infant cognition (novelty preference on visual recognition memory) (Oken, et al, EHP, 2005)
- The effect is reduced by co-exposure to mercury
- Women should eat fish during pregnancy but choose varieties with low mercury

Selenium and methylmercury

- Dietary selenium deficiency increases methylmercury neurotoxicity
- Conversely, selenium sufficiency reduces methylmercury neurotoxicity
- Data more robust in animal studies than in epidemiologic studies

The developing brain as a vulnerable ecosystem

- Ecosystems consist of multiple factors in complex interactions
- Feedback loops, resilience, adaptability
- The state of the system at a given time provides context for influence of single variables
- Impacts of neurotoxicants vary with nutrition, social stress/support
- How do we address them collectively?