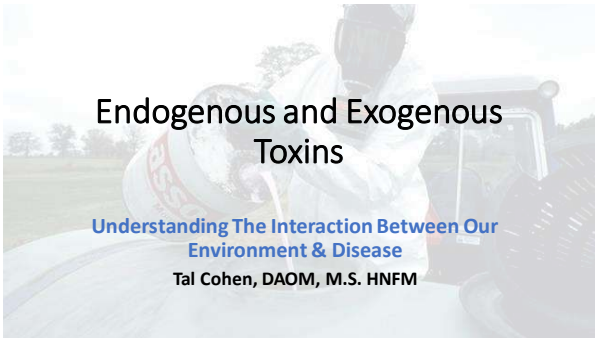


Endogenous and Exogenous Toxins

Understanding The Interaction Between Our Environment & Disease

Tal Cohen, DAOM, M.S. HNFM

1

"As recently as 2018, the TSCA (Toxic Substances Control Act of 1976) Inventory showed **over 86,000 chemicals available for commercial production and use in the U.S.**"

"Less than 20 percent of the chemicals in commerce that have confidential identities"

United States Environmental Protection Agency. EPA Releases First Major Update to Chemicals List in 40 Years. Retrieved online fromhttps://www.epa.gov/newsreleases/epa-releases-first-major-update-chemicals-list-40-years

2

"Each year, **an estimated 2,000 new ones are introduced** for use in such everyday items as **foods, personal care products, prescription drugs, household cleaners, and lawn care products**."

Department of Health and Human Services. National Toxicology Program. Purpose. Retrieved online from https://archive.epa.gov/oig/catalog/web/html/167.html

3

U.S. Environmental Protection Agency monitors these chemicals, but **The Toxic Substances Control Act** does not require chemicals be proven safe before they are allowed to be marketed

Black H. (2005). GAO sounds off on chemical regulation. Environmental health perspectives, 113(12), A828–A830. https://doi.org/10.1289/ehp.113-a828

4

Acute vs Chronic Exposure

5

Acute Toxic Exposure

In 2016, over 2 million exposures, with near 50% of incidents in young children under 6 years-old.

Most common exposure includes cosmetics and personal care products in children under 6 and pain medication in adults above age 20.

Poison Control. National Capital Poison Center. Poison Statistics 2016. National Data.

6

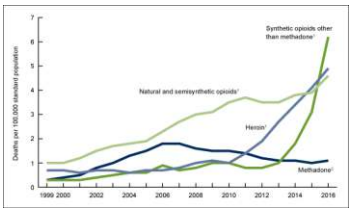
Drug toxicity remains one of the leading causes of death:
About 9,000 children (1999 to
Over 770,000 Americans (1999 to 2017)

1. Gaither, J. R., Shabanova, V., & Leventhal, J. M. (2018). US National Trends in Pediatric Deaths From Prescription and Illicit Opioids, 1999-2016. JAMA network open, 1(8), e186558. https://doi.org/10.1001/jamanetworkopen.2018.6558
2. CDC/National Center for Health Statistics. NCHS Releases New Monthly Provisional Estimates on Drug Overdose Deaths. https://www.cdc.gov/nchs/pressroom/podcasts/20190911/20190911.htm

7

Drug overdose death rates, by selected age group: United States, 1999–2016

Hedegaard H, Warner M, Miniño AM. Drug overdose deaths in the United States, 1999–2016. NCHS Data Brief, no 294. Hyattsville, MD: National Center for Health Statistics. 2017.



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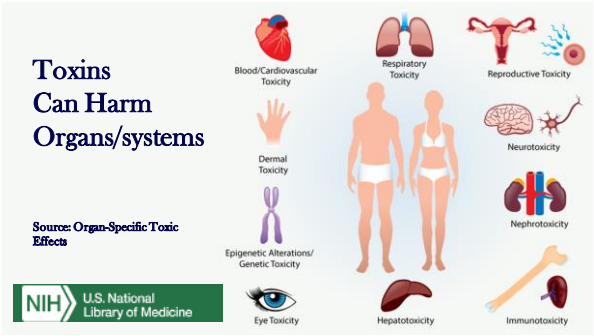
Chronic Exposure & Chronic Diseases

9



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11

*"Currently, studies have shown that **genetic predisposition** accounts for approximately **thirty percent of all autoimmune diseases**.*

*The rest, **70 percent, are due to environmental factors,** including toxic chemicals, dietary components, gut dysbiosis, and infections."*

Vojdani, A., Pollard, K. M., & Campbell, A. W. (2014). Environmental triggers and autoimmunity. Autoimmune diseases, 2014, 798029. https://doi.org/10.1155/2014/798029

12

Heavy metals & Joint Degeneration

Studies evaluating the affect of chemicals and inflammation found:

Environmental toxins were associated with metabolic dysregulation, inflammation, and were associated with arthritis and osteoarthritis (OA).

OXFORD JOURNALS American Journal of Epidemiology

1. Innes, K. E., Ducatman, A. M., Luster, M. I., & Shankar, A. (2011). Association of Osteoarthritis With Serum Levels of the Environmental Contaminants Perfluorooctanoate and Perfluorooctane Sulfonate in a Large Appalachian Population. American Journal of Epidemiology, 174(4), 440–450.
2. Edwards, C. J., & Cooper, C. (2006). Early environmental factors and rheumatoid arthritis. Clinical and Experimental Immunology, 143(1), 1–5. http://doi.org/10.1111/j.1365-2249.2005.02940..x
3. *Edwards, C. J., & Cooper, C. (2006). Early environmental factors and rheumatoid arthritis. Clinical and Experimental Immunology, 143(1), 1–5. http://doi.org/10.1111/j.1365-2249.2005.02940.x*

13

What about heavy metals?

study of 9,447 participants of the 1999–2010

Higher levels of heavy metals were associated with greater levels of insulin resistance.

American Diabetes Association. SUBSCRIBE SEARCH CURRENT CONTENT diabetes

Menke, A., Guallar, E., & Cowie, C. C. (2016). Metals in Urine and Diabetes in U.S. Adults. Diabetes, 65(1), 164–171. doi:10.2337/db15-0316

14

15

16

17

Main Sources of Chemical Exposure

18

19

Herbicide Glyphosate

- patented as an herbicide in 1971
- glyphosate in food, water, and air means that it is ingested on a frequent basis
- Regularly found in adult's and children's urine (occasionally at levels above limit of detection)
- The safety levels in commercial formulations is controversial
- Evidence of harm in humans is based on speculations and not substantiated by experimental evidence

1. Mesnage, R., & Antoniou, M. N. (2017). Facts and Fallacies in the Debate on Glyphosate Toxicity. Frontiers in public health, 5, 316. https://doi.org/10.3389/fpubh.2017.00316
2. Niemann, L., Sieke, C., Pfeil, R. et al. A critical review of glyphosate findings in human urine samples and comparison with the exposure of operators and consumers. J. Verbr. Lebensm. 10, 3–12 (2015). https://doi.org/10.1007/s00003-014-0927-3

20

Herbicide Glyphosate

- Evidence exists that glyphosate-based herbicides are toxic below regulatory set safety limits
- Animals study show functional damage in kidneys following chronic ingestion of ultra-low dosage glyphosate-base herbicide (Roundup).

1. Mesnage, R., & Antoniou, M. N. (2017). Facts and Fallacies in the Debate on Glyphosate Toxicity. Frontiers in public health, 5, 316. https://doi.org/10.3389/fpubh.2017.00316
2. Mesnage R, Arno M, Costanzo M, Malatesta M, Séralini GE, Antoniou MN. Transcriptome profile analysis reflects rat liver and kidney damage following chronic ultra-low dose Roundup exposure [published correction appears in Environ Health. 2017 Mar 23;16(1):28]. Environ Health. 2015;14:70. Published 2015 Aug 25. doi:10.1186/s12940-015-0056-1

21

Herbicide Glyphosate

- Animal studies show functional damage in liver following chronic ingestion of ultra-low dosage glyphosate-base herbicide (Roundup).
- Led to activation of glutathione and ascorbate free radical scavenger systems, which confirmed lipotoxic condition and **oxidative stress**
- Increase in blood triglyceride levels, but no cholesterol
- Implied the development of non-alcoholic fatty liver disease

1. Mesnage R, Renney G, Séralini GE, Ward M, Antoniou MN. Multiomics reveal non-alcoholic fatty liver disease in rats following chronic exposure to an ultra-low dose of Roundup herbicide [published correction appears in Sci Rep. 2018 Aug 17;8(1):12572]. Sci Rep. 2017;7:39328. Published 2017 Jan 9. doi:10.1038/srep39328

22

Herbicide Glyphosate

- Despite limited evidence in humans, based on "sufficient" and "strong" evidence from animal studies on genotoxicity
- It appears that glyphosate damage DNA and might lead to mutation
- In March 2015, International Agency for Research on Cancer (World Health Organization) classified glyphosate as "probably carcinogenic to humans" (Group 2A)

International Agency for Research on Cancer. World Health Organization. IARC Monograph on Glyphosate. Retrieved online from https://www.iarc.fr/featured-news/media-centre-iarc-news-glyphosate/

23

"Studies suggest that pesticides may be related to various diseases, including **cancers**, as well as having **neurological, mental and reproductive effects.**"

Cohen M. Environmental toxins and health--the health impact of pesticides. Australian Family Physician [serial online]. December 2007;36(12):1002-1004. Available from: MEDLINE Complete, Ipswich, MA. Accessed October 30, 2017.

24

Exposure to pesticides and other endocrine-disrupting chemical led to **dysfunction of the uterus, polycystic ovary syndrome, infertility, and other hormonal disorders.**

"Only 5% of breast cancer cases are the inherited."

Bhatt R. Environmental influence on reproductive health. International Journal of Gynecology & Obstetrics. 2000;70(1):69-75. doi:10.1016/s0020-7292(00)00221-6.
Rutkowska AZ, Diamanti-Kandarakis E. Polycystic ovary syndrome and environmental toxins. Fertility and Sterility. 2016;106(4):948-958. doi:10.1016/j.fertnstert.2016.08.031.

25

How environmental toxins effect your (patients') thyroid?

26

Partial List of Environmental Agents That Interfere with Thyroid Function

Agent	*Example of sources*	*Mode of action*	*Associated as a trigger or accelerating autoimmune thyroid disease*
PCBs	Found in coolants and lubricants, multiple congeners, lipophilic	TR agonist/antagonist, can alter levels of T4 and TSH	Possible increase in TSH, thyroid autoantibodies, thyroid volume

PCBs, polychlorinated biphenyls; TR, thyroid hormone receptor; T4, thyroxine; TSH, thyrotropin; UDPGTs, uridine diphosphate glucuronyltransferase; PBDE, polybrominated diphenylethers; HT, Hashimoto's thyroiditis; BPA, Bisphenol-A; TPO, thyroid peroxidase.

Brent, G. A. (2010). Environmental Exposures and Autoimmune Thyroid Disease. *Thyroid, 20*(7), 755–761. http://doi.org/10.1089/thy.2010.1636

27

Partial List of Environmental Agents That Interfere with Thyroid Function

Agent	*Example of sources*	*Mode of action*	*Associated as a trigger or accelerating autoimmune thyroid disease*
BPA	Used in plastic bottles	Antagonize TR	No human studies establishing association

PCBs, polychlorinated biphenyls; TR, thyroid hormone receptor; T4, thyroxine; TSH, thyrotropin; UDPGTs, uridine diphosphate glucuronyltransferase; PBDE, polybrominated diphenylethers; HT, Hashimoto's thyroiditis; BPA, Bisphenol-A; TPO, thyroid peroxidase.

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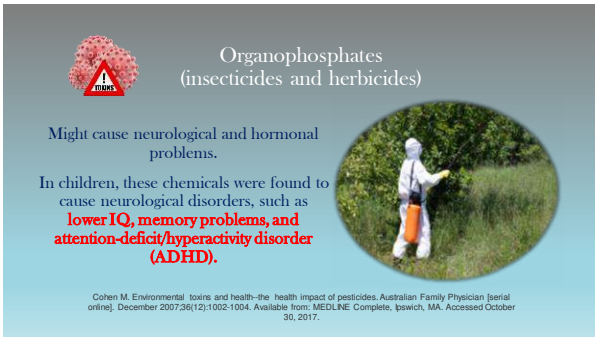


29

30

Organophosphates
(insecticides and herbicides)

Is organic food really healthier?

31

Organophosphates
(insecticides and herbicides)

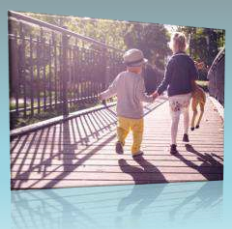
A study conducted in Seattle, Washington.

Measurement of dietary organophosphorus pesticide exposure in a group of 23 elementary school-age children through urinary biomonitoring twice a day.

They substituted most of children's conventional diets with organic food items for 5 consecutive days.

32

Organophosphates
(insecticides and herbicides)



The researches found that the urinary concentrations of the specific metabolites of organophosphates (malathion and chlorpyrifos) **decreased to the non-detected levels immediately after the introduction of organic diets.**

It also stayed 'nondetectable' until the conventional diets were reintroduced.

33

Organophosphates (insecticides and herbicides)

"In conclusion, we were able to demonstrate that an organic diet provides **a dramatic and immediate protective effect against exposures to organophosphorus pesticides** that are commonly used in agricultural production."

Lu C, Toepel K, Irish R, Fenske RA, Barr DB, Bravo R. Organic Diets Significantly Lower Children's Dietary Exposure to Organophosphorus Pesticides. *Environmental Health Perspectives.* 2006;114(2):260-263. doi:10.1289/ehp.8418.

34

Chronic Exposure at Home

35

Polybrominated Diphenyl Ethers (PBDEs) are a new class of organic contaminants that have been found in air, soil, humans, breastmilk, wildlife, and fish.

They are flame retardants chemicals that are added to electronics and textiles (e.g. fabrics and furniture) to prevent fire.

Daniels JL, Pan IJ, Jones R, et al. Individual characteristics associated with PBDE levels in U.S. human milk samples. Environ Health Perspect. 2010;118(1):155-60.

36

Accumulation of PBDEs is associated with **neurological problems**, such as low learning and memory ability, as well as cancer and thyroid dysfunction.

Daniels JL, Pan IJ, Jones R, et al. Individual characteristics associated with PBDE levels in U.S. human milk samples. Environ Health Perspect. 2010;118(1):155-60.

37

Polychlorinated Biphenyl (PCB) are man made chemicals (resistant to extreme heat or pressure) that is found in electronics, water, plastics, and pesticides.

They have been found in air, water, and soil and have no taste or smell and are clear in color.

38

Is the Diabetes Triggered by Environmental Toxins (Polychlorinated Biphenyls)?

"Significant associations between elevated PCB levels and diabetes mostly due to associations in women and in individuals < 55 years of age."

Should we test?

ehp Environmental Health Perspectives

Silverstone AE, Rosenbaum PF, Weinstock RS, Bartell SM, Foushee HR, Shelton C, Pavuk M. Polychlorinated biphenyl (PCB) exposure and diabetes: results from the Anniston Community Health Survey. Environ Health Perspect. 2012 May;120(5):727-32. doi: 10.1289/ehp.1104247. Epub 2012 Feb 14. PubMed PMID: 22334129; PubMed Central PMCID: PMC3346783.

39

Can Chemical Exposure Contribute to the Development of Diabetes?

A connection was found between environmental toxins, such as Bisphenol A (BPA), and weight gain and insulin resistance.

Anoop Shankar, Srinivas Teppala; Relationship between Urinary Bisphenol A Levels and Diabetes Mellitus. J Clin Endocrinol Metab 2011; 96 (12): 3822-3826. doi: 10.1210/jc.2011-1682

40

Are PCBs dangerous?

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

Accumulation of PCBs might lead to hormonal imbalance, skin conditions, dysfunction of thyroid, liver damage, and cancer.

Children might suffer from neurobehavioral and developmental problems.

Agency for Toxic Substances and Disease Registry. Polychlorinated Biphenyls (PCBs) Toxicity What Are Adverse Health Effects of PCB Exposure? Published 14, updated 2016.

41

Heavy Metals

42

Mercury

- Different chemical forms: elemental (or metallic), inorganic, and organic (methylmercury and ethyl mercury).
- Organic mercury, covalently bound to carbon, is the most dangerous form of mercury to human health.
- Reports on neurotoxicity, nephrotoxicity, and immunotoxicity.

Bose-O'Reilly, S., McCarty, K. M., Steckling, N., & Lettmeier, B. (2010). Mercury exposure and children's health. *Current problems in pediatric and adolescent health care*, *40*(8), 186–215. https://doi.org/10.1016/j.cppeds.2010.07.002

43

Mercury

- Exposed through air (factory emissions), water (oceans, rivers, and other water bodies), food, and soil
- Fish with highest amount of mercury is mackerel, swordfish, tilefish, and fresh tuna
- Lowest mercury in scallop, shrimp, sardine, and salmon

Food and Drug Administration. Mercury Levels in Commercial Fish and Shellfish (1990-2012). Retrieved from https://www.fda.gov/food/metals-and-your-food/mercury-levels-commercial-fish-and-shellfish-1990-2012

44

Mercury Exposure in Health Care

45

3 Sources of Mercury Exposure in Health Care:

- Dental fillings (amalgam) contains up to 50% elemental mercury
- Vaccines containing ethyl mercury as a preservative
- Mercury-containing measuring devices, such as thermometers or some medical tubes

Bose-O'Reilly, S., McCarty, K. M., Steckling, N., & Lettmeier, B. (2010). Mercury exposure and children's health. Current problems in pediatric and adolescent health care, 40(8), 186–215. https://doi.org/10.1016/j.cppeds.2010.07.002

46

In comparison to MS patients that had their dental fillings removed, patients with MS and dental fillings had significantly lower levels of

- **Red blood cells**
- **Hemoglobin and hematocrit**
- **Thyroxine (T4)**
- **Total T Lymphocytes**
- **T-8 (CD8) suppressor cells**
- **Serum IgG**

Siblerud RL, Kienholz E. Evidence that mercury from silver dental fillings may be an etiological factor in multiple sclerosis. Sci Total Environ. 1994;142(3):191-205. doi:10.1016/0048-9697(94)90327-1

Picture source: Wikipedia. Author: Michael Ottenbruch. Date published 21 June 2004

47

Patients with MS with dental fillings had significant increase in their symptoms in comparison to the MS patients who had their dental fillings removed.

Siblerud RL, Kienholz E. Evidence that mercury from silver dental fillings may be an etiological factor in multiple sclerosis. Sci Total Environ. 1994;142(3):191-205. doi:10.1016/0048-9697(94)90327-1

Picture source: Wikipedia. Author: Michael Ottenbruch. Date published 21 June 2004

48

Hair mercury was significantly higher in the MS patients compared to the non-MS control group.

Siblerud RL, Kienholz E. Evidence that mercury from silver dental fillings may be an etiological factor in multiple sclerosis. Sci Total Environ. 1994;142(3):191-205. doi:10.1016/0048-9697(94)90327-1

Picture source: Wikipedia. Author: Michael Ottenbruch. Date published 21 June 2004

49

Mercury in Vaccines

- American Academy of Pediatrics and the US Public Health Service requested to remove it from vaccins in 1999
- Measurement of blood, stool, and urine for levels of mercury, in newborns, infants, and young children, before and after **thimerosal-containing vaccines** detected an increase in levels of mercury in the stool.
- Levels remain high for 30 days

Pichichero ME, Gentile A, Giglio N, et al. Mercury levels in newborns and infants after receipt of thimerosal-containing vaccines. Pediatrics. 2008;121(2):e208-e214. doi:10.1542/peds.2006-3363

50

Mercury in Vaccines

- The topic of vaccines and Autism in children is controversial
- Thimerosal hasn't been used in vaccines for children since 2001
- **Thimerosal is still used in some flu vaccines**
- You can ask for flu vaccine without it

Centers for Disease Control and Prevention. FAQ about Thimerosal. https://www.cdc.gov/vaccinesafety/concerns/thimerosal/faqs.html

51

Environmental Exposure in Children

- Tens of thousands of children work in small-scale gold mines of Africa, Asia, and South America
- Methylmercury is excreted into breast milk
- Could also be caused by take-home exposure from parents who work in an environment with high exposure, such as construction, metal factories,

Grandjean P, Jørgensen PJ, Weihe P. Human milk as a source of methylmercury exposure in infants. Environ Health Perspect. 1994;102(1):74-77. doi:10.1289/ehp.9410274

52

Environmental Exposure in Children

- Prenatal exposure to mercury is reported to be associated with diminished neurological development
- Included reduction in IQ points, decreased performance in tests, and reduced memory, attention, language, and spatial cognition.
- Other symptoms include seizures, ataxia, vision and hearing loss, tremor, and high blood pressure.

Bose-O'Reilly, S., McCarty, K. M., Steckling, N., & Lettmeier, B. (2010). Mercury exposure and children's health. Current problems in pediatric and adolescent health care, 40(8), 186–215. https://doi.org/10.1016/j.cppeds.2010.07.002

53

Exposure to mercury could cause irritation to the immune system and persistent inflammation and pain in the back, neck, or other joints.

Best Practice & Research Clinical Rheumatology

Karataş GK, Tosun AK, Karacehennem E, Sepici V. Mercury Poisoning: An Unusual Cause of Polyarthritis. Clinical Rheumatology. 2002;21(1):73-75. doi:10.1007/s100670200018.

54

Aluminum

55

Aluminum Exposure & Health Concerns

- Exposure through
  - Aluminum-containing food packaging
  - Cosmetic products (such as antiperspirants, sunblock creams, and toothpaste)
  - Drugs (antacid agents)
  - airborne dust
  - allergy injections
  - Small amounts of aluminum are added to help the body build stronger immunity against the pathogen in the vaccine

1. EFSA (European Food Safety Authority) Safety of aluminium from dietary intake, scientific opinion of the panel on food additives, flavourings, processing aids and food contact materials (AFC) EFSA Journal. 2008:1–34.
2. CDC. What is an adjuvant and why is it added to a vaccine? Retrieved from https://www.cdc.gov/vaccinesafety/concerns/adjuvants.html

56

Aluminum Exposure & Health Concerns

- Neurotoxic effect in humans and animals
- A meta-analysis published in 2015 concluded that individuals with chronic exposure to aluminum were 71% more likely to develop Alzheimer's Disease
- Conflicting evidence on carcinogenicity
  - Only around 0.1% of orally absorbed – the rest from inhalation of mercury vapor
  - Symptoms of chronic exposure: tremor, anxiety, emotional lability, forgetfulness, insomnia, anorexia, and fatigue.

1. Wang Z, Wei X, Yang J, et al. Chronic exposure to aluminum and risk of Alzheimer's disease: A meta-analysis. Neurosci Lett. 2016;610:200-206. doi:10.1016/j.neulet.2015.11.014
2. Agency for Toxic Substances and Disease Registry. Medical Management Guidelines for Mercury. Retrieved from https://www.atsdr.cdc.gov/MMG/MMG.asp?id=106&tid=24

57

Study of 67 male workers (range 23-55 years) working in aluminum factory reported:

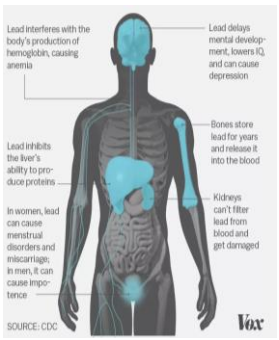
- **Headache (41,8%)**
- **Increased emotional irritability (56,7%)**
- **Concentration difficulty (22,4%)**
- **Insomnia (22,4%)**
- **Mood lability (14,9%)**
- **Neurological examination: No organic lesions in the central or peripheral nervous system**
- **Visual evoked potentials (VEP) exam revealed abnormalities**

Sińczuk-Walczak H, Matczak W, Ranlewska G, Szymczak M. Neurologiczna i neurofizjologiczna ocena pracowników zawodowo narażonych na glin [Neurologic and neurophysiologic examinations of workers occupationally exposed to aluminium]. Med Pr. 2005;56(1):9-17.

58

Lead

59



Lead is highly toxic.

The main sources of lead exposure are lead based paints, gasoline, cosmetics, toys, household dust, contaminated soil, industrial emissions

ehp Environmental Health Perspectives

Gerhardsson, L., Dahlin, L., Knebel, R., & Schütz, A. (2002). Blood lead concentration after a shotgun accident. Environmental health perspectives, 110(1), 115–117. doi:10.1289/ehp.02110115

60

Heavy metals & Joint Degeneration

A study published in the Journal Environmental Health Perspectives, evaluated the effect of lead on Bone and Joints:

Lead affects joint and bone remodeling cells, causing impaired collagen synthesis.

Pounds JG, Long GJ, Rosen JF. Cellular and molecular toxicity of lead in bone. Environ Health Perspect. 1991 Feb; 91():17-32.

61

Heavy metals & Joint Degeneration

A study published in the Arthritis Research & Therapy measured 1,635 participants

association between whole blood lead levels and the presence and severity of osteoarthritis.

Nelson, A. E., Shi, X. A., Schwartz, T. A., Chen, J.-C., Renner, J. B., Caldwell, K. L., ... Jordan, J. M. (2011). Whole blood lead levels are associated with radiographic and symptomatic knee osteoarthritis: a cross-sectional analysis in the Johnston County Osteoarthritis Project. Arthritis Research & Therapy, 13(2), R37. http://doi.org/10.1186/ar3270

62

What about heavy metals?

study of 9,447 participants of the 1999–2010

Higher levels of heavy metals were associated with greater levels of insulin resistance.

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Menke, A., Guallar, E., & Cowie, C. C. (2016). Metals in Urine and Diabetes in U.S. Adults. Diabetes, 65(1), 164–171. doi:10.2337/db15-0316

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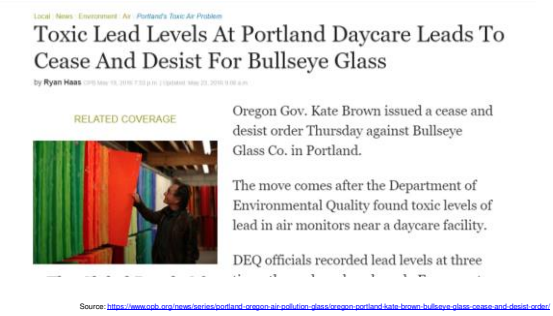


Local · News · Environment · Air · Portland's Toxic Air Problem

Toxic Lead Levels At Portland Daycare Leads To Cease And Desist For Bullseye Glass

by Ryan Haas

RELATED COVERAGE

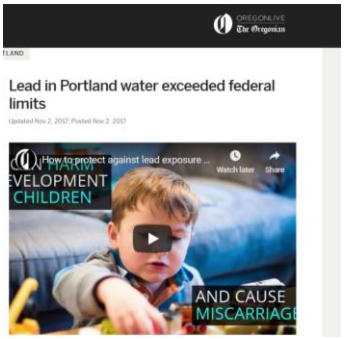
Oregon Gov. Kate Brown issued a cease and desist order Thursday against Bullseye Glass Co. in Portland.

The move comes after the Department of Environmental Quality found toxic levels of lead in air monitors near a daycare facility.

DEQ officials recorded lead levels at three

Source: https://www.opb.org/news/series/portland-oregon-air-pollution-glass/oregon-portland-kate-brown-bullseye-glass-cease-and-desist-order/

64



OREGONLIVE The Oregonian

FLAND

Lead in Portland water exceeded federal limits

Updated Nov 2, 2017; Posted Nov 2, 2017

How to protect against lead exposure ...

Watch later Share

EVELOPMENT CHILDREN

AND CAUSE MISCARRIAGE

65

Mold Exposure

66

Mold Exposure & Chronic Disease

- Mold spores are present in all indoor environments and cannot be eliminated from them.
- Association between mold and risk of asthma
- Association between Dampness or mold and depression

1. Hardin BD, Kelman BJ, Saxon A. Adverse human health effects associated with molds in the indoor environment. J Occup Environ Med. 2003;45(5):470-478. doi:10.1097/00043764-200305000-00006
2. Quansah, R., Jaakkola, M. S., Hugg, T. T., Heikkinen, S. A., & Jaakkola, J. J. (2012). Residential dampness and molds and the risk of developing asthma: a systematic review and meta-analysis. PloS one, 7(11), e47526. https://doi.org/10.1371/journal.pone.0047526
3. Shenassa, E. D., Daskalakis, C., Liebhaber, A., Braubach, M., & Brown, M. (2007). Dampness and mold in the home and depression: an examination of mold-related illness and perceived control of one's home as possible depression pathways. American journal of public health, 97(10), 1893–1899. https://doi.org/10.2105/AJPH.2006.093773

67

Mold Exposure & Chronic Disease

- 104 out of 112 patients (93%) with chronic fatigue syndrome were tested positive for at least one mycotoxin
- Mechanisms of disease due to mold exposure is estimated to be inflammation, oxidative stress, and allergic reaction

1. Hardin BD, Kelman BJ, Saxon A. Adverse human health effects associated with molds in the indoor environment. J Occup Environ Med. 2003;45(5):470-478. doi:10.1097/00043764-200305000-00006
2. Brewer, J. H., Thrasher, J. D., Straus, D. C., Madison, R. A., & Hooper, D. (2013). Detection of mycotoxins in patients with chronic fatigue syndrome. Toxins, 5(4), 605–617. https://doi.org/10.3390/toxins5040605
3. Hope J. (2013). A review of the mechanism of injury and treatment approaches for illness resulting from exposure to water-damaged buildings, mold, and mycotoxins. TheScientificWorldJournal, 2013, 767482. https://doi.org/10.1155/2013/767482

68

Acrylamide

69

Acrylamide

- Lack of evidence from human studies
- Animal studies show carcinogenic reaction
- In 1994, International Agency for Research on Cancer (IARC) classifies acrylamide as a "**probable human carcinogen**."

National Institute of Health. National Cancer Institute. Acrylamide and Cancer Risk. Retrieved from https://www.cancer.gov/about-cancer/causes-prevention/risk/diet/acrylamide-fact-sheet
National Cancer Institute. Acrylamide and Cancer Risk: www.cancer.gov/about-cancer/causes-prevention/risk/diet/acrylamide-fact-sheet

70

Acrylamide exposure from several sources:

- is a chemical used primarily to make substances called polyacrylamide used in production of paper, dyes, and plastics, in the treatment of drinking water and wastewater, including sewage
- Smoking: three to five times higher levels of acrylamide exposure
- First detected in food in 2002
- **major food sources of acrylamide are French fries and potato chips; crackers, bread, and cookies; breakfast cereals; canned black olives; prune juice; and coffee**

1. National Institute of Health. National Cancer Institute. Acrylamide and Cancer Risk. Retrieved from https://www.cancer.gov/about-cancer/causes-prevention/risk/diet/acrylamide-fact-sheet
2. Virk-Baker MK, Nagy TR, Barnes S, Groopman J. Dietary acrylamide and human cancer: a systematic review of literature. Nutrition and Cancer 2014;66(5):774-790. [PubMed Abstract]

71

Acrylamide can be produced when cooking foods that contain the amino acid asparagine and reducing sugars such as glucose and fructose, such as potatoes, are heated to high temperatures in the presence of certain sugars through Maillard reactions

National Institute of Health. National Cancer Institute. Acrylamide and Cancer Risk. Retrieved from https://www.cancer.gov/about-cancer/causes-prevention/risk/diet/acrylamide-fact-sheet

72

Studies reported that tolerable daily intake (TDI) for neurotoxicity was estimated to be 40 mcg/kg-day, for cancer was estimated to be 2.6 and 16 mcg/kg-day (not based on government data)

Acrylamide intake in adults is estimated at average of 0.5 mcg/kg and toddlers from the cereal-based baby food was 1.43 µg/kg of body weight per day.

Exposure in children, from high to low: bread, crackers, biscuits, baby biscuits, powdered cereal-based baby foods, baby bread-rusks and breakfast cereals

1. Tardiff RG, Gargas ML, Kirman CR, Carson ML, Sweeney LM. Estimation of safe dietary intake levels of acrylamide for humans. Food Chem Toxicol. 2010;48(2):658-667. doi:10.1016/j.fct.2009.11.048
2. Mucci LA, Wilson KM. Acrylamide intake through diet and human cancer risk. J Agric Food Chem. 2008;56(15):6013-6019. doi:10.1021/jf703747b
3. Cengiz MF, Gündüz CP. Acrylamide exposure among Turkish toddlers from selected cereal-based baby food samples. Food Chem Toxicol. 2013;60:514-519. doi:10.1016/j.fct.2013.08.018

73

Animal studies show that repeated administration of Acrylamide in high dosages (50 mg/kg × 10 days) depleted GSH content as well GST activity in the brain

Neurotoxicity is the only toxic effect of acrylamide proven in humans.

Clinical signs were mild peripheral neuropathies such as upper and lower limb numbness and tingling

1. Kumar, J., Das, S., & Teoh, S. L. (2018). Dietary Acrylamide and the Risks of Developing Cancer: Facts to Ponder. Frontiers in nutrition, 5, 14. https://doi.org/10.3389/fnut.2018.00014
2. LoPachin RM. The changing view of acrylamide neurotoxicity. Neurotoxicology. 2004;25(4):617-630. doi:10.1016/j.neuro.2004.01.004
3. Hagmar L, Törnqvist M, Nordander C, et al. Health effects of occupational exposure to acrylamide using hemoglobin adducts as biomarkers of internal dose. Scand J Work Environ Health. 2001;27(4):219-226. doi:10.5271/sjweh.608

74

Reduce acrylamide by reducing cooking time and the method and temperature of the cooking process.

- ✓ Reduce high temperature cooking, such as frying, roasting, grilling, or baking for starchy food
- ✓ Forms at lower levels, in dairy, meat, and fish products
- ✓ Boiling and steaming do not typically form acrylamide
- ✓ Eat more fresh food with antioxidants
- ✓ Studies showing significant reduction in acrylamide by increasing antioxidants in food, whole grains vs refined

1. National Institute of Health. National Cancer Institute. Acrylamide and Cancer Risk. Retrieved from https://www.cancer.gov/about-cancer/causes-prevention/risk/diet/acrylamide-fact-sheet
2. Food and Drug Administration. Acrylamide Questions and Answers. Retrieved from https://www.fda.gov/food/chemicals/acrylamide-questions-and-answers#2
3. Haase NU, Grothe KH, Matthäus B, Vosmann K, Lindhauer MG. Acrylamide formation and antioxidant level in biscuits related to recipe and baking. Food Addit Contam Part A Chem Anal Control Expo Risk Assess. 2012;29(8):1230-1238. doi:10.1080/19440049.2012.690349

75

Exposure to chemicals months or years before symptoms started.

76

Construction work, brick laying, tilling, and cement work might increase exposure to silica, which is associated with developing RA, systemic sclerosis, and systemic lupus erythematosus.

Miller, F. W., Alfredsson, L., Costenbader, K. H., Kamen, D. L., Nelson, L. M., Norris, J. M., & De Roos, A. J. (2012). Epidemiology of environmental exposures and human autoimmune diseases: findings from a National Institute of Environmental Health Sciences Expert Panel Workshop. Journal of autoimmunity, 39(4), 259–271. https://doi.org/10.1016/j.jaut.2012.05.002

77

"Workplace chemical exposures have been linked to cancers, and other lung, kidney, skin, heart, stomach, brain, nerve, and reproductive diseases."

United States Department of Labor. Occupational Safety and Health Administration. Transitioning to Safer Chemicals: A Toolkit for Employers and Workers. Retrieved online: https://www.osha.gov/dsg/safer_chemicals/#1

78

A meta-analysis published in 2017 concluded that:

"The findings suggest that people, and especially children, are **exposed on a daily basis to multiple chemicals in dust** with known or suspected health effects."

Zota, A. R., Singla, V., Adamkiewicz, G., Mitro, S. D., & Dodson, R. E. (2017). Reducing chemical exposures at home: opportunities for action. *Journal of epidemiology and community health*, *71*(9), 937–940. Advance online publication. https://doi.org/10.1136/jech-2016-208676

79

Phenolic resins (human made polymers consisting of phenol) is found in

1. Plywood adhesive, construction, automotive, and appliance industries
2. Bisphenol A which is used primarily in the manufacture polycarbonate plastics
3. Manufacture of nylon

Barlow J., Johnson JAP. BREAST CANCER & THE ENVIRONMENT RESEARCH CENTERS Early Life Exposure to Phenols and Breast Cancer Risk in Later Years: FACT SHEET on PHENOLS, Breast Cancer and the Environment Research Centers.

80

At least 90% of dust samples collected in studies had flame retardants and phenols.

Zota, A. R., Singla, V., Adamkiewicz, G., Mitro, S. D., & Dodson, R. E. (2017). Reducing chemical exposures at home: opportunities for action. *Journal of epidemiology and community health*, *71*(9), 937–940. Advance online publication. https://doi.org/10.1136/jech-2016-208676

81

Phenolic exposure occurs from the following sources:

1. Air: Combustion of wood, fuel emissions and tobacco
2. Ingestion of contaminated water (e.g. plastic bottles)
3. Naturally in food and food packaging (e.g. foods include
4. tomatoes, apples, peanuts, bananas, oranges, cocoa, and red grapes.
5. Skin Contact from products such as dental sealants, sunscreen, lotions, hand soap, and toothpaste.
6. Small amounts produced internally by breakdown of protein by bacteria in gut

Barlow J., Johnson JAP. BREAST CANCER & THE ENVIRONMENT RESEARCH CENTERS Early Life Exposure to Phenols and Breast Cancer Risk in Later Years: FACT SHEET on PHENOLS, Breast Cancer and the Environment Research Centers.

82

- Phenols can cross the placenta and were found in breast milk.
- Accumulates in fat tissue. Mothers with higher BMI had higher levels of phenols.

Barlow J., Johnson JAP. BREAST CANCER & THE ENVIRONMENT RESEARCH CENTERS Early Life Exposure to Phenols and Breast Cancer Risk in Later Years: FACT SHEET on PHENOLS, Breast Cancer and the Environment Research Centers.

83

- 70% of 325 colostrum samples, from middle class Korean women, had detectable levels of BPA.
- In USA about 75% (breast milk for 3 to 15 months infants)
- BPA was detected in 42% of infant urine

1. Yi, B., Kim, C., Park, M., Han, Y., Park, J. Y., & Yang, M. (2013). Association between Endocrine Disrupting Phenols in Colostrums and Maternal and Infant Health. International journal of endocrinology, 2013, 282381. https://doi.org/10.1155/2013/282381.
2. Völkel W, Kiranoglu M, Fromme H. Determination of free and total bisphenol A in urine of infants. Environ Res. 2011;111(1):143-148. doi:10.1016/j.envres.2010.10.001
3. Mendonca K, Hauser R, Calafat AM, Arbuckle TE, Duty SM. Bisphenol A concentrations in maternal breast milk and infant urine. Int Arch Occup Environ Health. 2014;87(1):13-20. doi:10.1007/s00420-012-0834-9

84

Phenol is absorbed well through the GI and skin.

Phenol is detoxified by conjugation (phase II) and eliminated through urine and small amounts through expired air through the feces.

Conjugation of Phenol requires glutathione.

Barlow J., Johnson JAP. BREAST CANCER & THE ENVIRONMENT RESEARCH CENTERS Early Life Exposure to Phenols and Breast Cancer Risk in Later Years: FACT SHEET on PHENOLS, Breast Cancer and the Environment Research Centers.

85

Measuring Phenols in Urine

Measure levels of 2,5-dichlorophenol (25-DCP), a breakdown product of phenol.

In sample of 1,000 U.S adults, 98% had detectable levels of 2,5-dichlorophenol in their urine and 96% had detectable levels of p-dichlorobenzene in their blood.

No change between age or gender in blood or urine levels.

Hill RH Jr, Ashley DL, Head SL, Needham LL, Pirkle JL. p-Dichlorobenzene exposure among 1,000 adults in the United States. Arch Environ Health. 1995;50(4):277-280. doi:10.1080/00039896.1995.9935954

86

Supplements & Harmful Toxicants

87

Heavy Metals in Supplements:

- 26 commonly used prenatal vitamin brands were tested for heavy metals (including one prescription brand) from Canadian health-food store
- All samples contained Lead with average amounts (0.535 mcg)
- 20 samples exceeded established standards for lead toxicity (0.50 µgm/day)
- All samples contained Aluminum, Nickel, Titanium and Thallium
- Inorganic arsenic levels were above acceptable limits

Schwalfenberg, G., Rodushkin, I., & Genuis, S. J. (2018). Heavy metal contamination of prenatal vitamins. *Toxicology reports*, *5*, 390–395. https://doi.org/10.1016/j.toxrep.2018.02.015

88

Heavy Metals in Supplements:

- Intentional contamination with banned substances are higher in weight loss, sexual performance, and muscle-building supplements.
- Manufacturers do not FDA approval before producing or selling dietary supplements
- Buy supplements from reputable companies with third-party lab testing

Mathews NM. Prohibited Contaminants in Dietary Supplements. Sports Health. 2018;10(1):19-30. doi:10.1177/1941738117727736

89

Medication & Toxic Load

90

"The chemicals most often associated with development of autoimmunity in humans are medications."

Pollard, K. M., Hultman, P., & Kono, D. H. (2010). Toxicology of autoimmune diseases. Chemical research in toxicology, 23(3), 455–466. https://doi.org/10.1021/tx9003787

91

Drug-Induced Autoimmunity (DIA)

First described in 1945 as a side effect of sulfadiazine inducing lupus erythematosus

Xiao X, Chang C. Diagnosis and classification of drug-induced autoimmunity (DIA). J Autoimmun. 2014;48-49:66-72. doi:10.1016/j.jaut.2014.01.005

92

15,000 to 20,000 individuals each year develop lupus due to drugs

93

"More than 90 medications from more than 10 drug classes have been implicated in causing lupus"

Anyssa Garza, PharmD

1. Anyssa Garza, PharmD. Drug-Induced Autoimmune Diseases. Pharmacy Times. Published online January 2016
2. Araújo-Fernández S, Ahijón-Lana M, Isenberg DA. Drug-induced lupus: Including anti-tumour necrosis factor and interferon induced. Lupus. 2014;23(6):545-553. doi:10.1177/0961203314523871

94

Drugs associated with autoimmunity (Subacute Cutaneous Lupus Erythematosus):

- **Hydralazine**
- **Calcium channel blockers**
- **Beta blockers**
- **HMG-CoA reductase inhibitors (statins)**
- **Antifungal**
- **NSAIDS (e.g. naproxen)**
- **Antidepressants**
- **Biologicals (e.g. interferon-beta)**

1. Anyssa Garza, PharmD. Drug-Induced Autoimmune Diseases. Pharmacy Times. Published online January 2016
2. Chang C, Gershwin ME. Drug-induced lupus erythematosus: incidence, management and prevention. Drug Saf. 2011;34:357-374.

95

Drug-Induced Autoimmunity are most often mentioned as causing the following rheumatic diseases:

- systemic lupus erythematosus (SLE)
- Systemic sclerosis
- Systemic vasculitis
- Polymyositis and dermatomyositis
- Sjögren's syndrome

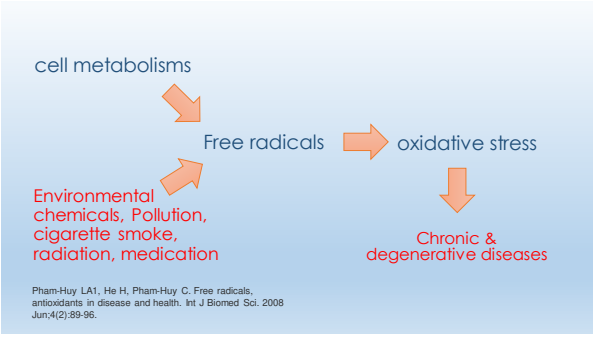
Niklas, K., Niklas, A. A., Majewski, D., & Puszczewicz, M. (2016). Rheumatic diseases induced by drugs and environmental factors: the state-of-the-art - part one. Reumatologia, 54(3), 122–127. https://doi.org/10.5114/reum.2016.61212

96

How Environmental Chemicals Cause Damage and Disease?

Pathophysiology Pathway #1

97



98

Oxidative Stress

Oxidative stress, also known as reactive oxygen species, can cause damage to both mitochondrial and nuclear DNA and is responsible for cancer development.

Free radicals, metals and antioxidants in oxidative stress-induced cancer. Valko M, Rhodes CJ, Moncol J, Izakovic M, Mazur M Chem Biol Interact. 2006 Mar 10; 160(1):1-40.

99

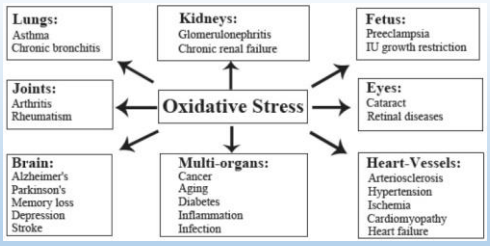
Oxidative Stress

Oxidative stress plays a major part in the development of chronic and degenerative illness, such as cancer, autoimmune disorders, accelerated aging, cataract, rheumatoid arthritis, cardiovascular, and neuro-degenerative diseases.

Pham-Huy LA, He H, Pham-Huy C. (2008) Free radicals, antioxidants in disease and health. Int J Biomed Sci. 4(2), 89-96.

International Journal of Biological and Biomedical Sciences

100

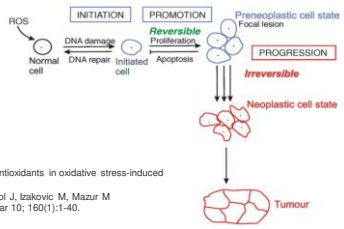


Pham-Huy LA, He H, Pham-Huy C. (2008) Free radicals, antioxidants in disease and health. Int J Biomed Sci. 4(2), 89-96.

International Journal of Biological and Biomedical Sciences

101

Oxidative Stress & Cancer



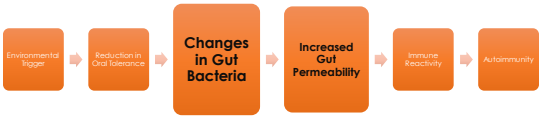
Free radicals, metals and antioxidants in oxidative stress-induced cancer.
Valko M, Rhodes CJ, Moncol J, Izakovic M, Mazur M
Chem Biol Interact. 2006 Mar 10; 160(1):1-40.

102

How Environmental Chemicals Cause Damage and Disease?

Pathophysiology Pathway #2

103



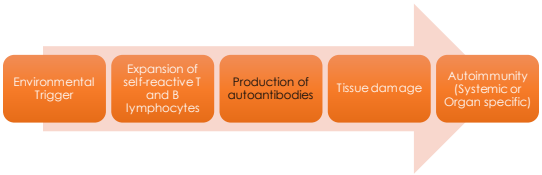
Vojdani, A., Pollard, K. M., & Campbell, A. W. (2014). Environmental triggers and autoimmunity. Autoimmune diseases, 2014, 798029. https://doi.org/10.1155/2014/798029

104

How Environmental Chemicals Cause Damage and Disease?

Pathophysiology Pathway #3

105



Pollard, K. M., Hultman, P., & Kono, D. H. (2010). **Toxicology of autoimmune diseases**. Chemical research in toxicology, 23(3), 455–466. https://doi.org/10.1021/tx9003787

106

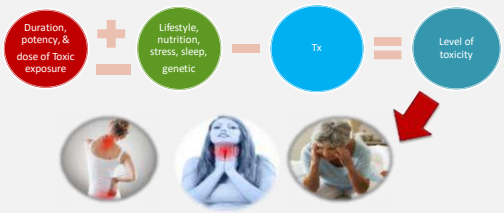
Considerations in Evaluation and Treatment of Chemical Accumulation

107

Symptoms and health problems are depending on three factors:

108

Symptoms and health problems are depending on three factors:



109

How to recognize accumulation of toxicants?

110

Symptoms of Toxic Accumulation

111

112

Symptoms & Conditions:

- **Patients who are not responsive to therapies that are known to be effective.**
- An autoimmune or hyper-immunity, such as allergies, Crohn's, or RA
- Neurological disorders, such as headaches, ADHD, or 'brain fog'
- Mood disorders, such as anger, irritability, or depression
- **Change of symptoms with environment, e.g. "I always feel worse at work"**
- 'Unexplained' Chronic fatigue
- Prolong constipation or less than one bowel movement per day
- Sensitive to smells, e.g dislikes perfumes or get nauseous with gas smell

113

Can chemicals cause us to gain fat?

114

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Science News *from research organizations*

Chemical exposure could lead to obesity, study finds

Date: April 20, 2016

Source: University of Georgia

Summary: Exposure to chemicals found in everyday products could affect the amount of fat stored in the body, according to a study. Phthalates are chemicals found in everything from plastic products to soap to nail polish -- they give plastic its bendy stretch.

Share:

RELATED TOPICS

Health & Medicine

- Obesity
- Vitamin D
- Diet and Weight Loss

FULL STORY

Exposure to chemicals found in everyday products could affect the amount of fat stored in the body, according to a study by University of Georgia researchers.

Chemicals & Fat

Lei Yin, Kevin Shengyang Yu, Kun Lu, Xiaozhong Yu. **Benzyl butyl phthalate promotes adipogenesis in 3T3-L1 preadipocytes: A High Content Cellomics and metabolomic analysis**. *Toxicology in Vitro*, 2016; 32: 297
DOI: 10.1016/j.tiv.2016.01.010

115

Exposure to chemical benzyl butyl phthalate (BBP) increase production of fat.

Lei Yin, Kevin Shengyang Yu, Kun Lu, Xiaozhong Yu. **Benzyl butyl phthalate promotes adipogenesis in 3T3-L1 preadipocytes: A High Content Cellomics and metabolomic analysis**. *Toxicology in Vitro*, 2016; 32: 297
DOI: 10.1016/j.tiv.2016.01.010

116

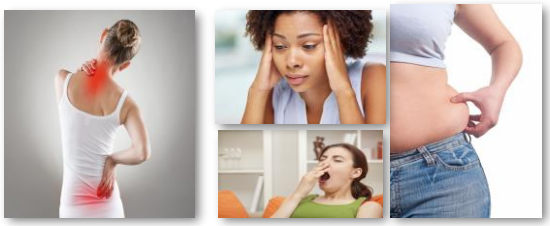
"Our study contributes to the growing body of evidence that BPA is positively associated with obesity."

Do, M. T., Chang, V. C., Mendez, M. A., & de Groh, M. (2017). Urinary bisphenol A and obesity in adults: results from the Canadian Health Measures Survey. Concentration urinaire de bisphénol A et obésité chez les adultes : résultats de l'Enquête canadienne sur les mesures de la santé. Health promotion and chronic disease prevention in Canada : research, policy and practice, 37(12), 403–412. https://doi.org/10.24095/hpcdp.37.12.02

Public Health Agency of Canada / Agence de la santé publique du Canada

Health Promotion and Chronic Disease Prevention in Canada
Research, Policy and Practice

117



Are your patients suffering from symptoms of toxic accumulation?

118

Lab Testing

119

Available testing through hair, blood, urine, and sweat

- measurements from blood and/or urine can provide misleading conclusions about the state of toxicant accumulation and underestimate the total body burden of xenobiotics.
- Measurement of heavy metals levels in sweat, urine, and plasma produced different results

Genuis, S. J., Birkholz, D., Rodushkin, I., & Beesoon, S. (2011). Blood, urine, and sweat (BUS) study: monitoring and elimination of bioaccumulated toxic elements. Archives Of Environmental Contamination And Toxicology, 61(2), 344-357. doi:10.1007/s00244-010-9611-5

120

Hair Analysis for Heavy Metals

- Potentially safe, simple, relatively affordable (typically $60-100), noninvasive, and extremely useful diagnostic tool, but is controversial
- Estimated that age and gender were not crucial factors for assessing metal concentrations in human hair.

1. Liang, G., Pan, L., & Liu, X. (2017). Assessment of Typical Heavy Metals in Human Hair of Different Age Groups and Foodstuffs in Beijing, China. *International journal of environmental research and public health*, *14*(8), 914. https://doi.org/10.3390/ijerph14080914
2. Manson, P., & Zlotkin, S. (1985). Hair analysis--a critical review. Canadian Medical Association journal, 133(3), 186–188.

121

Hair Analysis vs Urine Analysis

- Agreement on results for barium and lead
- Disagreement on results for copper and germanium
- Magnesium, selenium, and zinc levels low in hair (not urine)

- "Careful interpretation of diagnostic results can provide valuable information regarding"
- Personal recommendation: start with hair -> 24 hours urine

1. Blaurock-Busch, E., Amin, O. R., & Rabah, T. (2011). Heavy metals and trace elements in hair and urine of a sample of arab children with autistic spectrum disorder. Maedica, 6(4), 247–257.

122

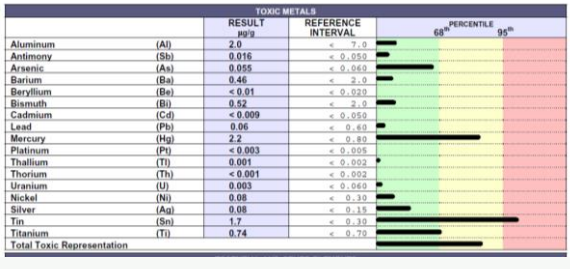
58yo, Female, hypertension

Toxic & Essential Elements; Hair

TOXIC METALS		RESULT ug/g	REFERENCE INTERVAL	PERCENTILE 68th 95th
Aluminum	(Al)	13	< 7.0	
Antimony	(Sb)	0.015	< 0.050	
Arsenic	(As)	0.035	< 0.060	
Barium	(Ba)	0.35	< 2.0	
Beryllium	(Be)	< 0.01	< 0.020	
Bismuth	(Bi)	0.72	< 2.0	
Cadmium	(Cd)	0.029	< 0.050	
Lead	(Pb)	0.13	< 0.60	
Mercury	(Hg)	0.21	< 0.80	
Platinum	(Pt)	< 0.003	< 0.005	
Thallium	(Tl)	< 0.001	< 0.002	
Thorium	(Th)	< 0.001	< 0.002	
Uranium	(U)	0.003	< 0.060	
Nickel	(Ni)	0.17	< 0.30	
Silver	(Ag)	0.27	< 0.15	
Tin	(Sn)	0.45	< 0.30	
Titanium	(Ti)	1.6	< 0.70	
Total Toxic Representation				

123

54yo, Female, chronic joint pain & inflammation

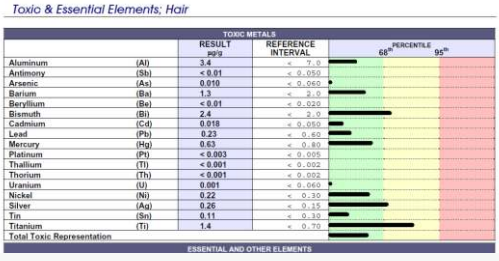


TOXIC METALS		RESULT µg/g	REFERENCE INTERVAL	PERCENTILE 68th 95th
Aluminum	(Al)	2.0	< 7.0	
Antimony	(Sb)	0.016	< 0.050	
Arsenic	(As)	0.055	< 0.060	
Barium	(Ba)	0.46	< 2.0	
Beryllium	(Be)	< 0.01	< 0.020	
Bismuth	(Bi)	0.52	< 2.0	
Cadmium	(Cd)	< 0.009	< 0.050	
Lead	(Pb)	0.06	< 0.60	
Mercury	(Hg)	2.2	< 0.80	
Platinum	(Pt)	< 0.003	< 0.005	
Thallium	(Tl)	0.001	< 0.002	
Thorium	(Th)	< 0.001	< 0.002	
Uranium	(U)	0.003	< 0.060	
Nickel	(Ni)	0.08	< 0.30	
Silver	(Ag)	0.08	< 0.15	
Tin	(Sn)	1.7	< 0.30	
Titanium	(Ti)	0.74	< 0.70	
Total Toxic Representation				

124

59yo, Female, Depression

Toxic & Essential Elements; Hair

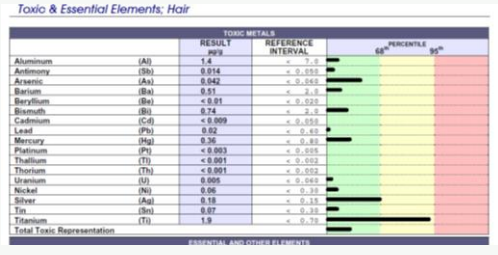


TOXIC METALS		RESULT µg/g	REFERENCE INTERVAL	PERCENTILE 68th 95th
Aluminum	(Al)	3.4	< 7.0	
Antimony	(Sb)	< 0.01	< 0.050	
Arsenic	(As)	0.010	< 0.060	
Barium	(Ba)	1.3	< 2.0	
Beryllium	(Be)	< 0.01	< 0.020	
Bismuth	(Bi)	2.4	< 2.0	
Cadmium	(Cd)	0.018	< 0.050	
Lead	(Pb)	0.23	< 0.60	
Mercury	(Hg)	0.63	< 0.80	
Platinum	(Pt)	< 0.003	< 0.005	
Thallium	(Tl)	< 0.001	< 0.002	
Thorium	(Th)	< 0.001	< 0.002	
Uranium	(U)	0.001	< 0.060	
Nickel	(Ni)	0.22	< 0.30	
Silver	(Ag)	0.26	< 0.15	
Tin	(Sn)	0.11	< 0.30	
Titanium	(Ti)	1.4	< 0.70	
Total Toxic Representation				
ESSENTIAL AND OTHER ELEMENTS				

125

60yo, Female, Mood swings, chronic joint pain

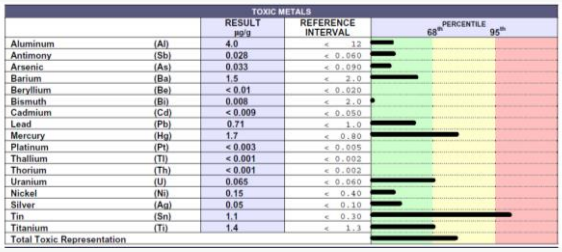
Toxic & Essential Elements; Hair



TOXIC METALS		RESULT µg/g	REFERENCE INTERVAL	PERCENTILE 68th 95th
Aluminum	(Al)	1.4	< 7.0	
Antimony	(Sb)	0.014	< 0.050	
Arsenic	(As)	0.042	< 0.060	
Barium	(Ba)	0.51	< 2.0	
Beryllium	(Be)	< 0.01	< 0.020	
Bismuth	(Bi)	0.74	< 2.0	
Cadmium	(Cd)	< 0.009	< 0.050	
Lead	(Pb)	0.02	< 0.60	
Mercury	(Hg)	0.36	< 0.80	
Platinum	(Pt)	< 0.003	< 0.005	
Thallium	(Tl)	< 0.001	< 0.002	
Thorium	(Th)	< 0.001	< 0.002	
Uranium	(U)	0.005	< 0.060	
Nickel	(Ni)	0.06	< 0.30	
Silver	(Ag)	0.18	< 0.15	
Tin	(Sn)	0.07	< 0.30	
Titanium	(Ti)	1.9	< 0.70	
Total Toxic Representation				
ESSENTIAL AND OTHER ELEMENTS				

126

69yo, Female, Alzheimer's Disease



TOXIC METALS

		RESULT µg/g	REFERENCE INTERVAL	PERCENTILE 68th 95th
Aluminum	(Al)	4.0	< 12	
Antimony	(Sb)	0.028	< 0.060	
Arsenic	(As)	0.033	< 0.090	
Barium	(Ba)	1.5	< 2.0	
Beryllium	(Be)	< 0.01	< 0.020	
Bismuth	(Bi)	0.008	< 2.0	
Cadmium	(Cd)	< 0.009	< 0.050	
Lead	(Pb)	0.71	< 1.0	
Mercury	(Hg)	1.7	< 0.80	
Platinum	(Pt)	< 0.003	< 0.005	
Thallium	(Tl)	< 0.001	< 0.002	
Thorium	(Th)	< 0.001	< 0.002	
Uranium	(U)	0.065	< 0.060	
Nickel	(Ni)	0.15	< 0.40	
Silver	(Ag)	0.05	< 0.10	
Tin	(Sn)	1.1	< 0.30	
Titanium	(Ti)	1.4	< 1.3	
Total Toxic Representation				

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Example For Testing of 172 Environmental Toxins

in Patient with Mood Swings and Chronic Back Pain

(GPL-TOX by Great Plains Labs or Doctors Data)

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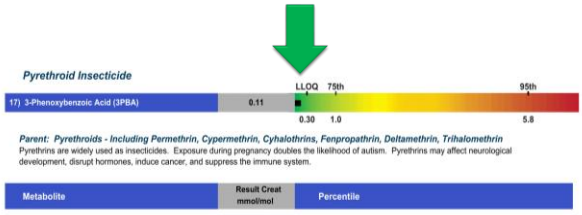
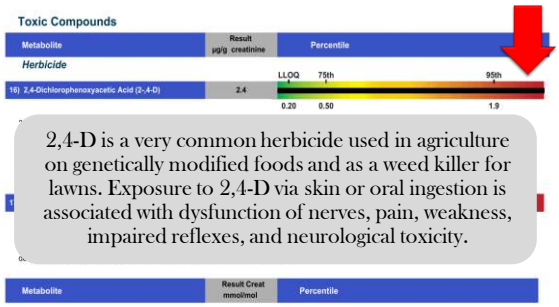


129



2,4-D is a very common herbicide used in agriculture on genetically modified foods and as a weed killer for lawns. Exposure to 2,4-D via skin or oral ingestion is associated with dysfunction of nerves, pain, weakness, impaired reflexes, and neurological toxicity.

130

Treatment Goals

1. **Reduce exposure** (work, home, car)
2. Improve/support detoxification
3. Maintain (healthy) bowel movement (1 to 3 per day)

131

A few free apps and websites that can help your patients:

- **Dirty Dozen** (lists the 12 fruits and vegetables with the most pesticide residues)
- **Think Dirty** (scan house-hold products)
- **Environmental Working Group Website** with guides to help reduce exposure to chemicals in your environment

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Reducing Exposure is Key!

- ✓ Clean or organic food
- ✓ Read food labels
- ✓ Free range animal protein
- ✓ Air filter at home
- ✓ Water filter (reverse osmosis)
- ✓ Reduce use of plastic and nonstick pans
- ✓ Don't heat or cook in plastic
- ✓ Exercise and sweat

133

Reducing Exposure is Key!

- ✓ "High-efficiency whole house filtration, high-efficiency particulate air sleep zone air filtration, and high-efficiency particulate air room air cleaners all appear to provide various degrees of benefit."

Sublett JL. Effectiveness of air filters and air cleaners in allergic respiratory diseases: a review of the recent literature. *Curr Allergy Asthma Rep*. 2011;11(5):395-402. doi:10.1007/s11882-011-0208-5

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My air filter

135

Reducing Exposure is Key!

- In 18 of the 59 households, arsenic concentrations exceeded 10 ppb in treated water
- RO systems removed an average of 80.2% of arsenic from well water.

Walker M, Seiler RL, Meinert M. Effectiveness of household reverse-osmosis systems in a Western U.S. region with high arsenic in groundwater. Sci Total Environ. 2008;389(2-3):245-252. doi:10.1016/j.scitotenv.2007.08.061

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Detox as a lifestyle

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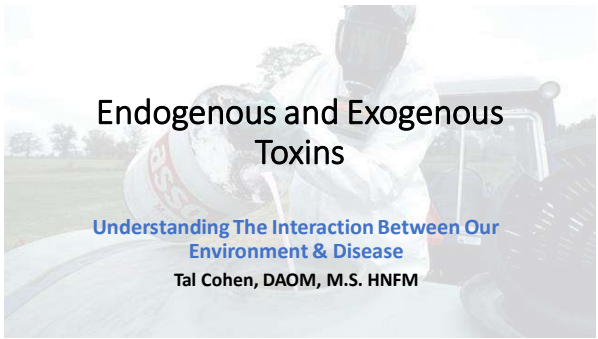

Endogenous and Exogenous Toxins

Understanding The Interaction Between Our Environment & Disease

Tal Cohen, DAOM, M.S. HNFM

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