



BPA-RELATED RISKS

- **BPA scientific monitoring since May 2009: An overall assessment**
- **Key Findings from April to June 2012**

Réseau Environnement Santé

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A/ BPA scientific monitoring since May 2009: An overall assessment

Number of studies on humans and animals

Showing effects: 296 (95 %)

- On animals: 186 (47 of which are *in vivo* studies that used a BPA dose < ADI (EFSA))
- On humans: 110 (Health effects: 48 ; *In vitro* effects : 62)

Showing no effect: 16

- On animals: 9
- On humans: 7

B/ BPA scientific monitoring from April to June 2012: A comprehensive overview

EFFECTS ON HUMANS

Adverse pathophysiological effects:

- There was a positive linear dose-response association between BPA urinary concentrations in 137 women undergoing in vitro fertilization and implantation failure.
- The analysis of data from 745 participants in the NHANES 2003-2004 showed that urinary BPA levels were significantly associated with peripheral arterial disease, independent of traditional CVD risk factors.
- The results suggest that prenatal exposure to BPA may affect child behavior (emotional reactivity, aggressiveness and anxiousness/depression), and differently among boys and girls.

In vitro effects:

- Genistein, bisphenol A and HPTE display mitogenic activities in ovarian cancer cells via their ability to activate the ER and upregulate CXCL12 expression. The study highlights a potential role of EDCs possessing estrogenic activities in the etiology of ovarian cancer.
- G protein-coupled receptor (GPER) is involved in the biological action elicited by BPA in breast cancer cells and cancer-associated fibroblasts.
- Normal human breast epithelial cells exposed to BPA increase expressions of genes involved in DNA repair in order to overcome the DNA damage induced by this chemical.
- BPA has estrogen-like activity and can stimulate human normal breast cells proliferation and cell division through the estrogen receptor pathway. BPA may have other pathways through which it can exert stimulating effects and exhibit non-genotoxic carcinogenicity.
- By rank order of estrogenic activity, NP, BPA, OP, BPB and BPF induce breast carcinoma cells proliferation. BPA and NP could also affect immune response and determine an allergic sensitisation.
- This study suggests that an involvement of BPA in the etiology of hypospadias might be associated with the downregulation of matrix metallopeptidase 11.

- BPA can reduce triglyceride accumulation during adipogenesis by attenuating the expression of lipoprotein lipase gene transcription in cultured human primary adult stem cells.
- BADGE can induce adipogenic differentiation in human and mouse multipotent mesenchymal stromal stem cells (MSCs). BPA and BADGE induce similar effects in preadipocytes at low nanomolar concentrations.
- Low concentrations of BPA promote lipid accumulation in hepatic cells triggered by disturbances in mitochondrial function, alterations in lipid metabolism and by inflammation that can therefore contribute to steatosis.

EFFECTS ON ANIMALS

Rats:

- Environmental estrogens such as BPA and genistein have distinct nongenomic effects in the developing uterus that determines their ability to promote uterine tumorigenesis.

Mice:

- BPA, MEHP, butylparaben, PCB 153 caused increased adipogenesis in murine adipocytes. The findings support the hypothesis that chemicals can interfere with adipocyte differentiation and potentially obesity development.

Monkey:

- Gestational exposure to BPA alters the developing mammary glands of female nonhuman primates in a comparable manner to that observed in rodents.



BPA RELATED RISKS

PEER-REVIEWED PAPERS (APRIL-JUNE 2012)
SOURCE: PubMed

Réseau Environnement Santé

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PAPER ANALYSES

A. EFFECTS ON HUMANS

1. ADVERSE PATHOPHYSIOLOGICAL EFFECTS:

➤ Hormonal system: thyroid disruption

Wang F, Hua J, Chen M, Xia Y, Zhang Q, Zhao R, Zhou W, Zhang Z, Wang B. **High urinary bisphenol A concentrations in workers and possible laboratory abnormalities.** Occup Environ Med. 2012 May 5. [Epub ahead of print] Department of Public Health, Gulou District Hua Qiao Road Community Health Service Center, Nanjing, China.

<http://www.ncbi.nlm.nih.gov/pubmed/22562051>

Higher occupational BPA exposure reflected in urinary concentrations of BPA in workers in two semiautomatic epoxy resin factories may be associated with thyroid hormone disruption.

➤ Reproduction

Ehrlich S, Williams PL, Missmer SA, Flaws JA, Berry KF, Calafat AM, Ye X, Petrozza JC, Wright D, Hauser R. **Urinary Bisphenol A Concentrations and Implantation Failure among Women Undergoing in Vitro Fertilization.** Environ Health Perspect. 2012 Jul. Epub 2012 Apr 6. Department of Environmental Health, Harvard School of Public Health, Boston, Massachusetts, USA.

<http://www.ncbi.nlm.nih.gov/pubmed/22484414>

This study found that there was a positive linear dose-response association between BPA urinary concentrations in 137 women undergoing in vitro fertilization and implantation failure.

➤ Cardiovascular disease

Shankar A, Teppala S, Sabanayagam C. **Bisphenol A and Peripheral Arterial Disease: Results from the NHANES.** Environ Health Perspect. 2012 May 29. [Epub ahead of print] West Virginia University School of Medicine.

<http://www.ncbi.nlm.nih.gov/pubmed/22645278>

The analysis of data from 745 participants in the NHANES 2003-2004 showed that urinary BPA levels were significantly associated with peripheral arterial disease, independent of traditional CVD risk factors.

➤ Behavioral effects

Perera F, Vishnevetsky J, Herbstman JB, Calafat AM, Xiong W, Rauh V, Wang S. **Prenatal bisphenol a exposure and child behavior in an inner-city cohort.** Environ Health Perspect. 2012 Aug. Epub 2012 Apr 27. Department of Environmental Health Sciences, Mailman School of Public Health, and.

<http://www.ncbi.nlm.nih.gov/pubmed/22543054>

The results suggest that prenatal exposure to BPA may affect child behavior (emotional reactivity, aggressiveness and anxiousness/depression), and differently among boys and girls.

2. IN VITRO EFFECTS:

➤ Hormone metabolism

Li Y, Burns KA, Arao Y, Luh CJ, Korach KS. **Differential Estrogenic Actions of Endocrine-Disrupting Chemicals Bisphenol A, Bisphenol AF, and Zearalenone through Estrogen Receptor α and β in Vitro**. Environ Health Perspect. 2012 Jul;120(7):1029-35. Epub 2012 Apr 11. Receptor Biology Section, Laboratory of Reproductive and Developmental Toxicology, National Institute of Environmental Health Sciences, National Institutes of Health, Department of Health and Human Services, Research Triangle Park, North Carolina, USA.
<http://www.ncbi.nlm.nih.gov/pubmed/22494775>

BPA and BPAF can function as EDCs by acting as cell type-specific agonists or antagonists for ER α and ER β . Zea also showed a strong estrogenic activity.

➤ Cancer

Chevalier N, Vega A, Bouskine A, Siddeek B, Michiels JF, Chevallier D, Fénichel P. **GPR30, the non-classical membrane G protein related estrogen receptor, is overexpressed in human seminoma and promotes seminoma cell proliferation**. PLoS One. 2012. Epub 2012 Apr 4. Institut National de la Santé et de la Recherche Médicale UMR U1065/UNS, Centre Méditerranéen de Médecine Moléculaire, Equipe 5 Environnement, Reproduction et Cancers Hormono-Dépendants, Nice, France.
<http://www.ncbi.nlm.nih.gov/pubmed/22496838>

G-protein coupled estrogen receptor (GPER) is overexpressed in seminoma tumours and should be considered rather than classical ERs when xeno-estrogens like BPA are assessed in testicular germ cell cancers.

Hall JM, Korach KS. **Endocrine disrupting chemicals promote the growth of ovarian cancer cells via the ER-CXCL12-CXCR4 signaling axis**. Mol Carcinog. 2012 Apr 30. [Epub ahead of print] College of Pharmacy and Health Sciences, Campbell University, Buies Creek, North Carolina.

<http://www.ncbi.nlm.nih.gov/pubmed/22549810>

Genistein, bisphenol A and HPTE display mitogenic activities in ovarian cancer cells via their ability to activate the ER and upregulate CXCL12 expression. The study highlights a potential role of EDCs possessing estrogenic activities in the etiology of ovarian cancer and foresees promising target for development of therapeutics for ER+ ovarian cancers.

Pupo M, Pisano A, Lappano R, Santolla MF, De Francesco EM, Abonante S, Rosano C, Maggiolini M. **Bisphenol A Induces Gene Expression Changes and Proliferative Effects through GPER in Breast Cancer Cells and Cancer-Associated Fibroblasts**. Environ Health Perspect. 2012 Aug. Epub 2012 May 2. Department of Pharmaco-Biology, University of Calabria, Rende, Italy.

<http://www.ncbi.nlm.nih.gov/pubmed/22552965>

The results indicate that the G protein-coupled receptor (GPER) is involved in the biological action elicited by BPA in breast cancer cells and cancer-associated fibroblasts. Hence, GPER-mediated signaling should be included among the transduction mechanisms through which BPA may stimulate cancer progression.

Fernandez SV, Huang Y, Snider KE, Zhou Y, Pogash TJ, Russo J. **Expression and DNA methylation changes in human breast epithelial cells after bisphenol A exposure.** Int J Oncol. 2012 Jul. Epub 2012 Apr 20. *Breast Cancer Research Laboratory, Fox Chase Cancer Center, Philadelphia, PA 19111, USA.*

<http://www.ncbi.nlm.nih.gov/pubmed/22576693>

Normal human breast epithelial cells exposed to BPA have increased expressions of genes involved in DNA repair in order to overcome the DNA damage induced by this chemical. These results suggest that the breast tissue of women with BRCA1 or BRCA2(1) mutations could be more susceptible to the effects of BPA.

Note :¹ genes involved in DNA repair

Wu S, Wei X, Jiang J, Shang L, Hao W. **Effects of bisphenol A on the proliferation and cell cycle of HBL-100 cells.** Food Chem Toxicol. 2012. Epub 2012 Jun 23. *Department of Toxicology, School of Public Health, Peking University, Beijing Key Laboratory of Toxicological Research and Risk Assessment for Food Safety, Beijing 100191, China.*

<http://www.ncbi.nlm.nih.gov/pubmed/22735500>

BPA has estrogen-like activity and can stimulate human normal breast cells proliferation and cell division through the estrogen receptor pathway. BPA may have other pathways through which it can exert stimulating effects and exhibit non-genotoxic carcinogenicity.

➤ Cancer and immune system

Pisapia L, Del Pozzo G, Barba P, Caputo L, Mita L, Viggiano E, Russo GL, Nicolucci C, Rossi S, Bencivenga U, Mita DG, Diano N. **Effects of some endocrine disruptors on cell cycle progression and murine dendritic cell differentiation.** Gen Comp Endocrinol. 2012 Aug. Epub 2012 Apr 17. *Institute of Genetics and Biophysics of CNR, Naples, Italy.*

<http://www.ncbi.nlm.nih.gov/pubmed/22531466>

This study shows that, by rank order of estrogenic activity, 4-n Nonylphenol (NP), Bisphenol A (BPA), Octylphenol (OP), Bisphenol B (BPB) and Bisphenol F (BPF) induce breast carcinoma cells proliferation. BPA and NP also induce the differentiation and activation of dendritic cells which could affect immune response and determine an allergic sensitisation.

➤ Genital defects

Qin XY, Kojima Y, Mizuno K, Ueoka K, Muroya K, Miyado M, Zaha H, Akanuma H, Zeng Q, Fukuda T, Yoshinaga J, Yonemoto J, Kohri K, Hayashi Y, Fukami M, Ogata T, Sone H. Identification of novel low-dose bisphenol a targets in *human foreskin fibroblast cells derived from hypospadias patients*. *PLoS One*. 2012. Epub 2012 May 4. Health Risk Research Section, Research Center for Environmental Risk, National Institute for Environmental Studies, Tsukuba, Ibaraki, Japan.

<http://www.ncbi.nlm.nih.gov/pubmed/22574217>

This study suggests that an involvement of BPA in the etiology of hypospadias might be associated with the downregulation of matrix metallopeptidase 11.

➤ Adipogenesis

Linehan C, Gupta S, Samali A, O'Connor L. Bisphenol A-mediated suppression of LPL gene expression inhibits triglyceride accumulation during adipogenic differentiation of human adult stem cells. *PLoS One*. 2012;7(5):e36109. Epub 2012 May 25. Department of Biochemistry, Faculty of Life Sciences, National University of Ireland Galway, Galway, Ireland.

<http://www.ncbi.nlm.nih.gov/pubmed/22662114>

The study shows for the first time that BPA can reduce triglyceride accumulation during adipogenesis by attenuating the expression of lipoprotein lipase gene transcription in cultured human primary adult stem cells.

Chamorro-García R, Kirchner S, Li X, Janesick A, Casey SC, Chow C, Blumberg B. Bisphenol A Diglycidyl Ether Induces Adipogenic Differentiation of Multipotent Stromal Stem Cells through a Peroxisome Proliferator-Activated Receptor Gamma-Independent Mechanism. *Environ Health Perspect*. 2012 Jul. Epub 2012 Apr 27. Department of Developmental and Cell Biology, University of California, Irvine, Irvine, California, USA.

<http://www.ncbi.nlm.nih.gov/pubmed/22763116>

BADGE can induce adipogenic differentiation in human and mouse multipotent mesenchymal stromal stem cells (MSCs). BPA and BADGE induce similar effects in preadipocytes at low nanomolar concentrations.

Huc L, Lemarié A, Guéraud F, Héliès-Toussaint C. Low concentrations of bisphenol A induce lipid accumulation mediated by the production of reactive oxygen species in the mitochondria of HepG2 cells. *Toxicol In Vitro*. 2012 Aug. Epub 2012 Apr 10. INRA, UMR1331, Toxalim, Research Centre in Food Toxicology, F-31027 Toulouse, France.

<http://www.ncbi.nlm.nih.gov/pubmed/22515966>

The authors showed that low concentrations of BPA promote lipid accumulation in hepatic cells triggered by disturbances in mitochondrial function, alterations in lipid metabolism and by inflammation that can therefore contribute to steatosis.

B. EFFECTS ON ANIMALS

a) RATS:

➤ Hormone metabolism

Feng Y, Yin J, Jiao Z, Shi J, Li M, Shao B. Bisphenol AF may cause testosterone reduction by directly affecting testis function in adult male rats. *Toxicol Lett.* 2012 Jun 1;211(2):201-9. Epub 2012 Apr 6.

Beijing Key Laboratory of Diagnostic and Traceability Technologies for Food Poisoning, Beijing Centre for Disease Control and Prevention, Beijing 100013, China.

<http://www.ncbi.nlm.nih.gov/pubmed/22504055>

The data demonstrate that BPAF-induced inhibition of testosterone production primarily resulted from the alteration of genes and proteins in the testosterone biosynthesis pathway.

➤ Cancer

Betancourt AM, Wang J, Jenkins S, Mobley J, Russo J, Lamartiniere CA. Altered carcinogenesis and proteome in mammary glands of rats after prepubertal exposures to the hormonally active chemicals bisphenol a and genistein. *J Nutr.* 2012 Jul;142(7):1382S-8S. Epub 2012 May 30. *Department of Pharmacology and Toxicology, University of Alabama at Birmingham, Birmingham, AL, USA.*

<http://www.ncbi.nlm.nih.gov/pubmed/22649256>

This study highlights the importance of proteomics technology in elucidating signaling pathways altered by exposure to hormonally active chemicals such as BPA and its potential value in identifying biomarkers for mammary cancer.

Greathouse KL, Bredfeldt T, Everitt JI, Lin K, Berry T, Kannan K, Mittelstadt ML, Ho SM, Walker CL. Environmental estrogens differentially engage the histone methyltransferase EZH2 to increase risk of uterine tumorigenesis. *Mol Cancer Res.* 2012 Apr. *Science Park Research Division, Department of Carcinogenesis, The University of Texas MD Anderson Cancer Center, Smithville, Texas, USA.*

<http://www.ncbi.nlm.nih.gov/pubmed/22504913>

Environmental estrogens such as BPA and genistein have distinct nongenomic effects in the developing uterus that determines their ability to promote uterine tumorigenesis.

➤ Nervous system

Inagaki T, Frankfurt M, Luine V. Estrogen-induced memory enhancements are blocked by acute bisphenol a in adult female rats: role of dendritic spines. *Endocrinology.* 2012 Jul. Epub 2012 May 8. *Department of Psychology, Hunter College of City University of New York, 695 Park Avenue, New York, New York 10065.*

<http://www.ncbi.nlm.nih.gov/pubmed/22569790>

The data show that doses of BPA, below the current Environmental Protection Agency safe limit of 50µg/kg, rapidly alter neural functions dependent on E2 in adult female rats.

Losa-Ward SM, Todd KL, McCaffrey KA, Tsutsui K, Patisaul HB. **Disrupted Organization of RFamide Pathways in the Hypothalamus Is Associated with Advanced Puberty in Female Rats Neonatally Exposed to Bisphenol A.** Biol Reprod. 2012 Aug 2;87(2):28. Print 2012. Department of Biology, North Carolina State University, Raleigh, North Carolina.

<http://www.ncbi.nlm.nih.gov/pubmed/22572997>

Neonatal exposure to 50 µg/kg of BPA induces premature puberty in female rats which results from decreased inhibition of GnRH neurons.

b) MICE :

➤ Nervous system

Jang YJ, Park HR, Kim TH, Yang WJ, Lee JJ, Choi SY, Oh SB, Lee E, Park JH, Kim HP, Kim HS, Lee J. **High dose bisphenol A impairs hippocampal neurogenesis in female mice across generations.** Toxicology. 2012 Jun 14. Epub 2012 Apr 3. Department of Pharmacy, College of Pharmacy and Research Institute for Drug Development, Longevity Life Science and Technology Institutes, Pusan National University, Geumjeong-gu, Busan 609-735, Republic of Korea.

<http://www.ncbi.nlm.nih.gov/pubmed/22484357>

The findings suggest that BPA exposure of pregnant mothers could adversely affect hippocampal neurogenesis and cognitive function in future generations (F2) by modulating the ERK and BDNF-CREB signaling cascades.

➤ Adipogenesis

Taxvig C, Dreisig K, Boberg J, Nellemann C, Schelde AB, Pedersen D, Boergesen M, Mandrup S, Vinggaard AM. **Differential effects of environmental chemicals and food contaminants on adipogenesis, biomarker release and PPAR γ activation.** Mol Cell Endocrinol. 2012 Sep 25. Epub 2012 Apr 14. Division of Toxicology and Risk Assessment, National Food Institute, Technical University of Denmark, Mørkhøj Bygade 19, DK-2860 Søborg, Denmark.

<http://www.ncbi.nlm.nih.gov/pubmed/22526026>

Four out of the eleven chemicals (BPA, MEHP, butylparaben, PCB 153) caused increased adipogenesis in murine adipocytes. Some of them (rosiglitazone, MEHP, butylparaben, PCB153...) were able to affect leptin, adiponectin, and resistin release and also induced lipid accumulation. The findings support the hypothesis that chemicals can interfere with adipocyte differentiation and potentially obesity development.

Chamorro-García R, Kirchner S, Li X, Janesick A, Casey SC, Chow C, Blumberg B. **Bisphenol A Diglycidyl Ether Induces Adipogenic Differentiation of Multipotent Stromal Stem Cells through a Peroxisome Proliferator-Activated Receptor Gamma-Independent Mechanism.** Environ Health Perspect. 2012 Jul. Epub 2012 Apr 27. Department of Developmental and Cell Biology, University of California, Irvine, Irvine, California, USA.

<http://www.ncbi.nlm.nih.gov/pubmed/22763116>

BADGE can induce adipogenic differentiation in human and mouse multipotent mesenchymal stromal stem cells (MSCs). BPA and BADGE induce similar effects in preadipocytes at low nanomolar concentrations.

➤ **Cancer and immune system (*in vitro*)**

Pisapia L, Del Pozzo G, Barba P, Caputo L, Mita L, Viggiano E, Russo GL, Nicolucci C, Rossi S, Bencivenga U, Mita DG, Diano N. **Effects of some endocrine disruptors on cell cycle progression and murine dendritic cell differentiation.** Gen Comp Endocrinol. 2012 Aug. Epub 2012 Apr 17. *Institute of Genetics and Biophysics of CNR, Naples, Italy.*

<http://www.ncbi.nlm.nih.gov/pubmed/22531466>

This study shows that, by rank order of estrogenic activity, 4-n Nonylphenol (NP), Bisphenol A (BPA), Octylphenol (OP), Bisphenol B (BPB) and Bisphenol F (BPF) induce breast carcinoma cells proliferation. BPA and NP also induce the differentiation and activation of dendritic cells which could affect immune response and determine an allergic sensitisation.

➤ **Immune system**

Roy A, Bauer SM, Lawrence BP. **Developmental exposure to bisphenol a modulates innate but not adaptive immune responses to influenza A virus infection.** PLoS One. 2012;7(6):e38448. Epub 2012 Jun 4. *Department of Environmental Medicine, University of Rochester School of Medicine and Dentistry, Rochester, New York, United States of America.*

<http://www.ncbi.nlm.nih.gov/pubmed/22675563>

Exposure of female mice during pregnancy and through lactation to the oral reference dose for BPA listed by the US EPA slightly modulates innate immunity in adult offspring, but does not impair the anti-viral adaptive immune response.

➤ **Epigenetic changes**

Zhang XF, Zhang LJ, Feng YN, Chen B, Feng YM, Liang GJ, Li L, Shen W. **Bisphenol A exposure modifies DNA methylation of imprint genes in mouse fetal germ cells.** Mol Biol Rep. 2012 Sep. Epub 2012 Jun 15. College of Biological and Pharmaceutical Engineering, Wuhan Polytechnic University, Wuhan, 430023, China.

<http://www.ncbi.nlm.nih.gov/pubmed/22699882>

Exposure of Pregnant mice to BPA can affect the DNA methylation of imprinting genes in fetal mouse germ cells.

➤ **Reproduction (*in vitro*)**

Aoki T, Takada T. **Bisphenol A modulates germ cell differentiation and retinoic acid signaling in mouse ES cells.** Reprod Toxicol. 2012 Jun 23. [Epub ahead of print] *Laboratory of Cell Engineering, Department of Pharmaceutical Sciences, Ritsumeikan University, Kusatsu, Shiga, Japan.*

<http://www.ncbi.nlm.nih.gov/pubmed/22732146>

The results, which suggest that BPA might affect testicular and ovarian development as well as germ cell differentiation, are consistent with the notion that BPA may have a feminizing effect on gonadal development in mammals.

Peretz J, Craig ZR, Flaws JA. Bisphenol A Inhibits Follicle Growth and Induces Atresia in Cultured Mouse Antral Follicles Independently of the Genomic Estrogenic Pathway. Biol Reprod. 2012 Jun 27. [Epub ahead of print]

<http://www.ncbi.nlm.nih.gov/pubmed/22743301>

In vitro culture of antral follicles with BPA shows that BPA abnormally regulates cell cycle and atresia factors, and this may lead to atresia and inhibited follicle growth, independently of the genomic estrogenic pathway.

C) MONKEY

➤ Mammary glands development

Tharp AP, Maffini MV, Hunt PA, VandeVoort CA, Sonnenschein C, Soto AM. Bisphenol A alters the development of the rhesus monkey mammary gland. Proc Natl Acad Sci U S A. 2012 May 22;109(21):8190-5. Epub 2012 May 7. Department of Anatomy and Cellular Biology, Tufts University School of Medicine, Boston, MA 02111, USA.

<http://www.ncbi.nlm.nih.gov/pubmed/22566636>

Gestational exposure to BPA leading to circulating levels of BPA comparable to that found in humans alters the developing mammary glands of female non-human primates in a comparable manner to that observed in rodents.

C. ENVIRONMENTAL EXPOSURE

Human impregnation studies:

➤ Fetal exposure

Edlow AG, Chen M, Smith NA, Lu C, McElrath TF. Fetal bisphenol A exposure: concentration of conjugated and unconjugated bisphenol A in amniotic fluid in the second and third trimesters. Reprod Toxicol. 2012 Aug. Epub 2012 Apr 10. Department of Obstetrics and Gynecology, Brigham and Women's Hospital, Harvard Medical School, 75 Francis Street, Boston, MA 02115, USA.

<http://www.ncbi.nlm.nih.gov/pubmed/22516041>

Total BPA was detected in 16/20 second trimester amniotic fluid samples whereas it was detected in only 2/20 third trimester samples. Free BPA was detected in a number of samples.

➤ Exposure factors

Martina CA, Weiss B, Swan SH. Lifestyle behaviors associated with exposures to endocrine disruptors. Neurotoxicology. 2012 Jun 21. [Epub ahead of print] Department of Community and Preventive Medicine,

School of Medicine and Dentistry, University of Rochester, 265 Crittenden Blvd., CU 420644, Rochester, NY 14642-0644, USA.

<http://www.ncbi.nlm.nih.gov/pubmed/22739065>

Pregnant women who consume mostly homegrown produce, who do not use cosmetics and who prefer other means of transportation than automobiles have lower urinary BPA and phthalates concentrations than NHANES pregnant women.

ENVIRONMENTAL CONTAMINATION

➤ BPS in paper and currency bill

Liao C, Liu F, Kannan K. **Bisphenol S, a new bisphenol analogue, in paper products and currency bills and its association with bisphenol a residues.** Environ Sci Technol. 2012 Jun 19;46(12):6515-22. Epub 2012 May 25. *Wadsworth Center, New York State Department of Health, and Department of Environmental Health Sciences, School of Public Health, State University of New York at Albany, Empire State Plaza, PO Box 509, Albany, New York 12201-0509, United States.*

<http://www.ncbi.nlm.nih.gov/pubmed/22591511>

BPS was analyzed in different paper types. Thermal receipt papers were found to be the major sources of human exposure to BPS (>88%). BPS was also detected in 87% of currency bill samples from 21 countries.

D. BPA: A GENERAL REVIEW

➤ Thyroid hormone

Andra SS, Makris KC. **Thyroid disrupting chemicals in plastic additives and thyroid health.** J Environ Sci Health C Environ Carcinog Ecotoxicol Rev. 2012. *Water and Health Laboratory, Cyprus International Institute for Environmental and Public Health in association with Harvard School of Public Health, Cyprus University of Technology, Limassol, Cyprus.*

<http://www.ncbi.nlm.nih.gov/pubmed/22690712>

This comprehensive review studied the magnitude and uncertainty of thyroid-disrupting chemicals (TDC) exposures and their effects on thyroid hormones for sensitive subpopulation groups. The authors' findings qualitatively suggest the mixed, significant TDC associations with natural thyroid hormones.

➤ Environmental decontamination processes

Husain Q, Qayyum S. **Biological and enzymatic treatment of bisphenol A and other endocrine disrupting compounds: a review.** Crit Rev Biotechnol. 2012 Jun 19. [Epub ahead of print] *Faculty of Applied Medical Sciences, Jazan University , Jazan , Kingdom of Saudi Arabia.*

<http://www.ncbi.nlm.nih.gov/pubmed/22712546>

This review examines the work on the presence of bisphenol A and other related EDs in the environment and their impact on the life of living organisms including human beings. Physicochemical and biological BPA degradation methods are discussed.

➤ **Neurotoxicology - Health risk assessment**

Weiss B. **The intersection of neurotoxicology and endocrine disruption.** Neurotoxicology. 2012 May 31. [Epub ahead of print] Department of Environmental Medicine, University of Rochester, School of Medicine and Dentistry, Rochester, NY 14642, United States.
<http://www.ncbi.nlm.nih.gov/pubmed/22659293>

This article deals with the complexity for neurotoxicologists to assess the health risks induced by endocrine disruptors such as BPA and phthalates because of their ability to produce a wide spectrum of health effects.

E. OTHER PAPERS

➤ **Toxicology : BPS versus BPA**

Grignard E, Lapenna S, Bremer S. Weak estrogenic transcriptional activities of Bisphenol A and Bisphenol S. Toxicol In Vitro. 2012 Aug; Epub 2012 Apr 5. European Commission, Joint Research Centre, Institute for Health and Consumer Protection, EURL ECVAM (European Union Reference Laboratory for Alternatives to Animal Testing), Via E. Fermi 2749, I-21027 Ispra (VA), Italy.

<http://www.ncbi.nlm.nih.gov/pubmed/22507746>

Bisphenol S is now often used as a substitute for bisphenol A but the authors warn that essays could demonstrate that the estrogenic activity of Bisphenol A and Bisphenol S is of a comparable potency.

➤ **Scientific controversy**

Siva N. **Controversy continues over safety of bisphenol A.** Lancet. 2012 Mar 31.

<http://www.ncbi.nlm.nih.gov/pubmed/22470929>

This article deals with the division in opinion among scientists, regulatory agencies, industry and certain groups regarding whether BPA poses a real risk to human health.

LIST OF UNCOMMENTED STUDIES

Flint S, Markle T, Thompson S, Wallace E. *Bisphenol A exposure, effects, and policy: a wildlife perspective*. J Environ Manage. 2012 Aug 15. Epub 2012 Apr 4. USA.

<http://www.ncbi.nlm.nih.gov/pubmed/22481365>

He Z, Paule MG, Ferguson SA. *Low oral doses of bisphenol A increase volume of the sexually dimorphic nucleus of the preoptic area in male, but not female, rats at postnatal day 21*. Neurotoxicol Teratol. 2012 May-Jun;34(3):331-7. Epub 2012 Apr 4. USA.

<http://www.ncbi.nlm.nih.gov/pubmed/22507915>

Duan B, Hu X, Zhao H, Qin J, Luo J. *The relationship between urinary bisphenol A levels and meningioma in Chinese adults*. Int J Clin Oncol. 2012 Apr 25. [Epub ahead of print] China.

<http://www.ncbi.nlm.nih.gov/pubmed/22527848>

Cao XL, Zhang J, Goodyer CG, Hayward S, Cooke GM, Curran IH. *Bisphenol A in human placental and fetal liver tissues collected from Greater Montreal area (Quebec) during 1998-2008*. Chemosphere. 2012 Oct. Epub 2012 Canada.

<http://www.ncbi.nlm.nih.gov/pubmed/22682542>

Kasper-Sonnenberg M, Wittsiepe J, Koch HM, Fromme H, Wilhelm M. *Determination of bisphenol a in urine from mother-child pairs-results from the duisburg birth cohort study, Germany*. J Toxicol Environ Health A. 2012. Germany.

<http://www.ncbi.nlm.nih.gov/pubmed/22686302>

Tainaka H, Takahashi H, Umezawa M, Tanaka H, Nishimune Y, Oshio S, Takeda K. *Evaluation of the testicular toxicity of prenatal exposure to bisphenol A based on microarray analysis combined with MeSH annotation*. J Toxicol Sci. 2012. Japan.

<http://www.ncbi.nlm.nih.gov/pubmed/22687993>

Moon MK, Kim MJ, Jung IK, Koo YD, Ann HY, Lee KJ, Kim SH, Yoon YC, Cho BJ, Park KS, Jang HC, Park YJ. *Bisphenol A impairs mitochondrial function in the liver at doses below the no observed adverse effect level*. J Korean Med Sci. 2012 Jun. Epub 2012 May 26. Korea.

<http://www.ncbi.nlm.nih.gov/pubmed/22690096>

Sánchez-Avila J, Tauler R, Lacorte S. *Organic micropollutants in coastal waters from NW Mediterranean Sea: Sources distribution and potential risk*. Environ Int. 2012 Oct. Epub 2012 Jun 15.

<http://www.ncbi.nlm.nih.gov/pubmed/22706016>

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