

## **Αυτισμός και περιβαλλοντικοί παράγοντες**

### **Autism and environmental factors**

της

Τσοπανίδου Βαρβάρας – Βασιλικής

Μεταπτυχιακή διατριβή που υποβάλλεται  
στην τριμελή επιτροπή για την απόκτηση του μεταπτυχιακού τίτλου του Προγράμματος  
Μεταπτυχιακών Σπουδών Εξειδίκευσης  
του Τ.Ε.Φ-Δ.Π.Θ. σε συνεργασία με το Ε.Κ.Ε.Φ.Ε. Δημόκριτος – Ινστιτούτο  
Πληροφορικής και Επικοινωνιών  
με τίτλο: «Εξειδίκευση στις Τ.Π.Ε. και Ειδική Αγωγή – Ψυχοπαιδαγωγική της ένταξης»

Εγκεκριμένο από την τριμελή επιτροπή:

1<sup>ος</sup> Επιβλέπων: Δρ. Δρίγκας Αθανάσιος, Ερευνητής Α' βαθμίδας, Ι.Π.Τ. Ε.Κ.Ε.Φ.Ε. "ΔΗΜΟΚΡΙΤΟΣ"

2ος Επιβλέπων: Σταθοπούλου Αγάθη Συνεργάτιδα Ερευνήτρια Ι.Π.Τ. Ε.Κ.Ε.Φ.Ε. "ΔΗΜΟΚΡΙΤΟΣ"

3ος Επιβλέπων: Δρ. Λουκέρης Διονύσιος, Συνεργαζόμενος Ερευνητής Ι.Π.Τ. Ε.Κ.Ε.Φ.Ε. "ΔΗΜΟΚΡΙΤΟΣ"

Αθήνα 2019

## ΠΕΡΙΛΗΨΗ

Ο αυτισμός είναι μια πολύπλοκη αναπτυξιακή διαταραχή και χαρακτηρίζεται από ελλείμματα στις κοινωνικές δεξιότητες και στην συμπεριφορά. Όσον αφορά την αιτιολογία, δεν υπάρχει μια μεμονωμένη αιτία αλλά πολλές θεωρίες που προσπαθούν να εξηγήσουν την εμφάνιση του αυτισμού. Τα αίτια αυτά θα μπορούσαν να πάρουν πολλές μορφές, όπως ελαττωματικά γονίδια, χρωμοσωματικές ανωμαλίες, μεταβολικές διαταραχές, μολυσματικοί ιοί. Το κάθε πιθανό αίτιο θα μπορούσε να επηρεάσει το ζωτικό σύστημα που εμπλέκεται στον αυτισμό, είτε επηρεάζει είτε όχι άλλα συστήματα (Frith, 1994). Οι εξελίξεις στη γενετική εντοπίζουν τη σχέση μεταξύ γονιδίων και αυτισμού, ενώ παράλληλα ερευνάται αν η έκθεση σε χημικές ουσίες «ενισχύει» την αυτιστική συμπεριφορά. Μια έμμεση απόδειξη για την «πυροδότηση» μιας αυτιστικής συμπεριφοράς εξαιτίας της έκθεσης σε χημικές ουσίες προέρχεται από μελέτες που αποδεικνύουν την ευαισθησία του οργανισμού σε ουσίες όπως ο μόλυβδος, η αιθυλική αλκοόλη και το μεθυλικό υδράργυρο (Landrigan, 2010). Η εργασία αυτή έχει ως στόχο να παρουσιάσει και να εκθέσει έρευνες και μελέτες, μέσα από την βιβλιογραφική ανασκόπηση, που αφορούν τους περιβαλλοντικούς παράγοντες που είτε επηρεάζουν είτε όχι την εκδήλωση του αυτισμού.

## ABSTRACT

Autism is a complex developmental disorder and is characterized by deficits in social skills and behavior. Regarding the aetiology, there is no single cause but many theories that try to explain the appearance of autism. These causes could take many forms, such as defective genes, chromosomal abnormalities, metabolic disorders, infectious viruses. Any possible cause could affect the vital system involved in autism, whether or not it affects other systems (Frith, 1994). Developments in genetics identify the relationship between genes and autism, while exploring whether exposure to chemicals "enhances" autistic behavior. An indirect demonstration of "triggering" an autistic behavior due to exposure to chemicals stems from studies demonstrating the body's sensitivity to substances such as lead, ethyl alcohol and methyl mercury (Landrigan, 2010). This paper aims to present and expose research and studies, through the bibliographic review, on the environmental factors that affect or not affect the manifestation of autism.

## BIBΛΙΟΓΡΑΦΙΑ

- Adams, J. B., Baral, M., Geis, E., Mitchell, J., Ingram, J., Hensley, A., ... & Mitchell, K. (2009). The severity of autism is associated with toxic metal body burden and red blood cell glutathione levels. *Journal of Toxicology*, 2009.
- Arndt TL, Stodgell CJ, Rodier PM. The teratology of autism. *Intern J Dev Neurosci* 2005; 23:189-199.
- Bandim JM, Ventura LO, Miller MT, Almeida HC, Costa AE (2003): Autism and Möbius sequence: An exploratory study in northeastern Brazil. *Arq Neuro Psiquiatr* 61:181–185.
- Baron-Cohen, S. (1995). Mindblindness: i dh f id Baron-Cohen, S. (2002). The extreme male brain theory of autism. *Trends in Cognitive Science*, 6, 248-254.
- Baron-Cohen, S., Knickmeyer, R. & Belmonte, M.K. (2005). Sex differences in the brain: Implications for explaining autism. *Science*, 310, 819-823. B C h S L li A M & F ith U 'theory of mind'? *Cognition*, 21, 37-46.
- Baron-Cohen, S., Wheelwright, S., Stone, V. & Rutherford, M. (1999). A mathematician, a physicist, and a computer scientist with Asperger psychology and folk physics test. *Neurocase*, 5, 475-483.
- Barton, H., 2008. Predicted intake of trace elements and minerals via household drinking water by 6-year-old children from Krakow, Poland. Part 3: aluminium. *Food Addit. Contam. Part A Chem. Anal. Control Expo. Risk Assess.* 25 (5), 588–603
- Barua S, Junaid MA. Lifestyle, pregnancy and epigenetic effects. *Epigenomics* 2015;7(1): 85-102.
- Bellinger, D. C., Trachtenberg, F., Barregard, L., Tavares, M., Cernichiari, E., Daniel, D., & McKinlay, S. (2006). Neuropsychological and renal effects of dental amalgam in children: a randomized clinical trial. *Jama*, 295(15), 1775-1783.
- Betts KS. Rapidly rising PBDE levels in North America. *Environ Sci Technol.* 2002; 36(3):50A–52A.
- Bhat AN, Landa RJ, Galloway JC. Current perspectives on motor functioning in infants, children, and adults with autism spectrum disorders. *PhysTher.* 2011;91(7):1116–29.

- Bouchard MF, Chevrier J, Harley KG, Kogut K, Vedar M, Calderon N, et al. Prenatal exposure to organophosphate pesticides and IQ in 7-year-old children. *Environ Health Perspect*. 2011;119(8):1189–95.
- Cabaton NJ, Canlet C, Wadia PR, Tremblay-Franco M, Gautier R, Molina J, Sonnenschein C, Cravedi JP, Rubin BS, Soto AM, Zalko D. Effects of low doses of bisphenol A on the metabolome of perinatally exposed CD-1 mice. *Environ Health Perspect*. 2013;121:586–593. [[PMC free article](#)][[PubMed](#)] [[Google Scholar](#)]
- Cnattingius, S. (2004). The epidemiology of smoking during pregnancy: Smoking prevalence, maternal characteristics, and pregnancy outcomes. *Nicotine & Tobacco Research*, 6(2), S125–S140.
- Chen, W., Landau, S., Sham, P., & Fombonne, E. (2004). No evidence for links between autism, MMR and measles virus. *Psychological medicine*, 34(3), 543-553.
- Chess S (1971): Autism in children with congenital rubella. *J Autism Child Schiz* 1:33– 47. **3**
- Chess S (1977): Follow-up report on autism in congenital rubella. *J Autism Child Schiz* 7:69 – 81.
- Conelly L., Conelly M., Elliot A., Farrell M., Arendt (2001). Οι ειδικές εκπαιδευτικές ανάγκες των παιδιών με αυτισμό. Ελληνική εταιρία Προστασίας Αυτιστικών Ατόμων, Αθήνα.
- Cornelius, M. D., De Genna, N. M., Leech, S. L., Willford, J. A., Goldschmidt, L., & Day, N. L. (2011). Effects of prenatal cigarette smoke exposure on neurobehavioral outcomes in 10-year-old children of adolescent mothers. *Neurotoxicology and Teratology*, 33, 137–144.
- Davies W, Isles AR, Wilkinson LS (2005): Imprinted gene expression in the brain. *Neurosci Behav Physiol* 29:421– 430.
- Davis, M. H., Luce, C., & Kraus, S. J. (1994). The heritability of characteristics associated with dispositional empathy. *Journal of personality*, 62(3), 369-391.
- Dawson, G. (1989). *Autism: Nature, Diagnosis and Treatment*. New York: Guilford Press.

- Desmond MM, Wilson GS, Melnick JL, Singer DB, Zion TE, Rudolph AJ, et al. (1970): Congenital rubella encephalitis: Course and early sequelae. *J Pediatr* 71:311–331.
- Dietert, R. R., Dietert, J. M., & DeWitt, J. C. (2011). Environmental risk factors for autism. *Emerging health threats journal*, 4(1), 7111.
- Dietert, R. R., Dietert, J. M., & DeWitt, J. C. (2011). Environmental risk factors for autism. *Emerging health threats journal*, 4(1), 7111.
- Dolonoy D, Huang D, Jirtle RL. Maternal nutrient supplementation counter-acts bisphenolA induced DNA hypomethylation in early development. *Proc Natl Acad Sci USA*. 2007;104:130556–113061. [[PMC free article](#)] [[PubMed](#)] [[Google Scholar](#)]
- Dufour-Rainfray D, Vourc'h P, Tourlet S, Guilloteau D, Chalon D, Andres CR. Fetal exposure to teratogens: Evidence of genes involved in autism. *Neurosci Biobehav Rev* 2011; 35:1254-1265.
- Eliassen, M., Tolstrup, J. S., Nybo Andersen, A. M., Grønbaek, M., Olsen, J., & Strandberg-Larsen, K. (2010). Prenatal alcohol exposure and autistic spectrum disorders—a population-based prospective study of 80 552 children and their mothers. *International journal of epidemiology*, 39(4), 1074-1081.
- Engel SM, Wetmur J, Chen J, Zhu C, Barr DB, Canfield RL, et al. Prenatal exposure to organophosphates, paraoxonase 1, and cognitive development in childhood. *Environ Health Perspect*. 2011;119(8):1182–8.
- Eskenazi, B., & Castorina, R. (1999). Association of prenatal maternal or postnatal child environmental tobacco smoke exposure and neurodevelopmental and behavioral problems in children. *Environmental Health Perspectives*, 107, 991–1000.
- Eskenazi B, Marks AR, Bradman A, Harley K, Barr DB, Johnson C, et al. Organophosphate pesticide exposure and neurodevelopment in young Mexican-American children. *Environ Health Perspect*. 2007;115(5):792–8.

- Fein, D., PENNINGTON, B., Markowitz, P., Braverman, M., & Waterhouse, L. (1986). Toward a neuropsychological model of infantile autism: are the social deficits primary?. *Journal of the American Academy of Child Psychiatry*, 25(2), 198-212.
- Fernell, E., Barnevik-Olsson, M., Bågenholm, G., Gillberg, C., Gustafsson, S., & Sääf, M. (2010). Serum levels of 25-hydroxyvitamin D in mothers of Swedish and of Somali origin who have children with and without autism. *Acta Paediatrica*, 99(5), 743-747.
- Fido, A., & Al-Saad, S. (2005). Toxic trace elements in the hair of children with autism. *Autism*, 9(3), 290-298.
- Fombonne E (2009): Epidemiology of pervasive developmental disorders. *Pediatr Review* 65:591–598.
- Frith, U., Happe, F., & Siddons, F. (in press). Theory of mind and social adaptation in autistic, retarded and young normal children. *Social Development*.
- Frith, U., (1999). Αυτισμός: Εξηγώντας το αίνιγμα (Μετάφραση). Αθήνα: Ελληνικά Γράμματα.
- Furlong MA, Herring A, Buckley JP, Goldman BD, Daniels JL, Engel LS, et al. Prenatal exposure to organophosphorus pesticides and childhood neurodevelopmental phenotypes. *Environ Res*. 2017;158:737–47.
- Galis F, Metz JAJ (2001): Testing the vulnerability of the phylotypic stage: On modularity and evolutionary conservation. *J Exp Zool* 291: 195–204.
- Geier, D. A., Kern, J. K., & Geier, M. R. (2009). A prospective study of prenatal mercury exposure from maternal dental amalgams and autism severity. *Acta Neurobiol Exp*, 69(2), 189-97.
- Geier, D. A., Kern, J. K., Garver, C. R., Adams, J. B., Audhya, T., Nataf, R., & Geier, M. R. (2009). Biomarkers of environmental toxicity and susceptibility in autism. *Journal of the Neurological Sciences*, 280(1-2), 101-108.

- Ghaziuddin M, Al-Khoury I, Ghaziuddin N (2002): Autistic symptoms following herpes encephalitis. *Eur Child Adolesc Psychiatry* 11:142–146.
- Gong, T., Dalman, C., Wicks, S., Dal, H., Magnusson, C., Lundholm, C., ... & Pershagen, G. (2016). Perinatal exposure to traffic-related air pollution and autism spectrum disorders. *Environmental health perspectives*, 125(1), 119-126.
- Grabrucker, A. M. (2013). Environmental factors in autism. *Frontiers in psychiatry*, 3, 118.
- Grandjean, P., Weihe, P., White, R. F., & Debes, F. (1998). Cognitive performance of children prenatally exposed to “safe” levels of methylmercury. *Environmental research*, 77(2), 165-172.
- Guxens, M., Ghassabian, A., Gong, T., Garcia-Esteban, R., Porta, D., Giorgis-Allemand, L., ... & Cesaroni, G. (2015). Air pollution exposure during pregnancy and childhood autistic traits in four European population-based cohort studies: the ESCAPE project. *Environmental health perspectives*, 124(1), 133-140.
- Happé, F. (2003). Theory of mind and the self. *Annals of the New York Academy of Sciences*, 1001(1), 134-144.
- Hertz-Picciotto, I., Bergman, Å., Fångström, B., Rose, M., Krakowiak, P., Pessah, I., ... & Bennett, D. H. (2011). Polybrominated diphenyl ethers in relation to autism and developmental delay: a case-control study. *Environmental Health*, 10(1), 1.
- Hertz-Picciotto, I., Green, P. G., Delwiche, L., Hansen, R., Walker, C., & Pessah, I. N. (2009). Blood mercury concentrations in CHARGE Study children with and without autism. *Environmental Health Perspectives*, 118(1), 161-166.
- Hertz-Picciotto I., Schmidt, R. J., Walker, C. K., Bennett, D. H., Oliver, M., Shedd-Wise, K. M., ... & Roa, D. L. (2018). A Prospective Study of Environmental Exposures and Early Biomarkers in Autism Spectrum Disorder: Design, Protocols, and Preliminary Data from the MARBLES Study. *Environmental health perspectives*, 126(11), 117004.

Hill DS, Cabrera R, Wallis Schultz D, Zhu H, Finnel RH, Wiodarcsyk BJ. Autism-Like Behavior and Epigenetic Changes Associated with Autism as Consequences of in Utero Exposure to Environmental Pollutants in a Mouse Model. *Behav Neurol*. 2015;2015:426263.

Hobson R. P. (1993). *Autism and Development of mind*. London, Erlbaum.

Holmes, A. S., Blaxill, M. F., & Haley, B. E. (2003). Reduced levels of mercury in first baby haircuts of autistic children. *International journal of toxicology*, 22(4), 277-285.

Jordan, Rita.- Powell, Stuart. (2000). Κατανόηση και Διδασκαλία Παιδιών με Αυτισμό. Μετάφραση: Ευφροσύνη Καλύβα. Αθήνα: ΕΕΠΑΑ

Kallia M. Brain development: anatomy, connectivity, adaptive plasticity, and toxicity. *Metabolism* 2008; 57(Suppl 2):2-5

Kalkbrenner AE, Daniels JL, Chen JC, Poole C, Emch M, Morrissey J. Perinatal exposure to hazardous air pollutants and autism spectrum disorders at age 8. *Epidemiology*. 2010;21:631–641.[[PMC free article](#)] [[PubMed](#)] [[Google Scholar](#)]

Kalkbrenner, A. E., Schmidt, R. J., & Penlesky, A. C. (2014). Environmental chemical exposures and autism spectrum disorders: a review of the epidemiological evidence. *Current problems in pediatric and adolescent health care*, 44(10), 277-318.

Kanner (1943). Autistic disturbances of affective contact

Kaur, K., Simon, A. F., Chauhan, V., & Chauhan, A. (2015). Effect of bisphenol A on *Drosophila melanogaster* behavior—A new model for the studies on neurodevelopmental disorders. *Behavioural brain research*, 284, 77-84.

Kern, J. K., Grannemann, B. D., Trivedi, M. H., & Adams, J. B. (2007). Sulfhydryl-reactive metals in autism. *Journal of Toxicology and Environmental Health, Part A*, 70(8), 715-721.



- Kim, D., Volk, H., Girirajan, S., Pendergrass, S., Hall, M. A., Verma, S. S., ... & Kim, K. (2017). The joint effect of air pollution exposure and copy number variation on risk for autism. *Autism Research, 10*(9), 1470-1480
- Kinney DK, Miller AM, Crowley DJ, Huang E, Gerber E (2008): Autism prevalence following prenatal exposure to hurricanes and tropical storms in Louisiana. *J Autism Dev Disord 38*:481– 488.
- Klin, A. (2000). Attributing social meaning to ambiguous visual stimuli in higher-functioning autism and Asperger syndrome: The social attribution task. *The Journal of Child Psychology and Psychiatry and Allied Disciplines, 41*(7), 831-846.
- Kongtip P, Techasaensiri B, Nankongnab N, Adams J, Phamonphon A, Surach A, et al. The impact of prenatal organophosphate pesticide exposures on Thai infant neurodevelopment. *Int J Environ Res Public Health. 2017;14*(6):570. <https://doi.org/10.3390/ijerph14060570>.
- Lai, M.C., Lombardo, M.V., Baron-Cohen, S., 2014. Autism. *Lancet 383*, 896–910.
- Lan A, Kalimian M, Amram B, Kofman O. Prenatal chlorpyrifos leads to autism-like deficits in C57Bl6/J mice. *Environ Health. 2017;16*(1):43.
- Lan, A., Stein, D., Portillo, M., Toiber, D., & Kofman, O. (2019). Impaired innate and conditioned social behavior in adult C57Bl6/J mice prenatally exposed to chlorpyrifos. *Behavioral and Brain Functions, 15*(1), 2.
- Land TG, Landau AS, Manning SE et al. Who underreports smoking on birth records: a Monte Carlo predictive model with validation. *PLoS One 2012;7*:e34853.
- Landrigan, P. J. (2010). What causes autism? Exploring the environmental contribution. *Current opinion in pediatrics, 22*(2), 219-225.

Lanphear, B.P., R. Hornung, J. Khoury, K. Yolton, P. Baghurst, D.C. Bellinger, R.L. Canfield, K.N. Dietrich, R. Bornschein, T. Greene, S.J. Rothenberg, H.L. Needleman, L. Schnaas, G. Wasserman, J. Graziano, and R. Roberts, 2005. Low-level environmental lead exposure and children's intellectual function: An international pooled analysis. *Environ. Health Perspect.*, 113: 894-899.

Larsson M, Weiss B, Janson S, Sundell J, Bornehag CG. Associations between indoor environmental factors and parental-reported autistic spectrum disorders in children 6–8 years of age. *Neurotoxicology*. 2009;30:822–831. [[PMC free article](#)] [[PubMed](#)] [[Google Scholar](#)]

Lee, B. K., Gardner, R. M., Dal, H., Svensson, A., Galanti, M. R., Rai, D., ... & Magnusson, C. (2012). Brief report: maternal smoking during pregnancy and autism spectrum disorders. *Journal of autism and developmental disorders*, 42(9), 2000-2005.

Lenz W, Knapp K (1962): Die thalidomide-embryopathie. *Dtsch Med Wochenschr* 87:1232–1242.

Lind Y, Darnerud PO, Atuma S, Aune M, Becker W, Bjerselius R, et al. Polybrominated diphenyl ethers in breast milk from Uppsala County, Sweden. *Environmental Research*. 2003; 93(2):186–194. [PubMed: 12963403]

Lyall, K., Croen, L. A., Weiss, L. A., Kharrazi, M., Traglia, M., Delorenze, G. N., & Windham, G. C. (2017). Prenatal serum concentrations of brominated flame retardants and autism spectrum disorder and intellectual disability in the Early Markers of Autism Study: a population-based case–control study in California. *Environmental health perspectives*, 125(8), 087023

Lyall, K., Munger, K. L., O'reilly, É. J., Santangelo, S. L., & Ascherio, A. (2013). Maternal dietary fat intake in association with autism spectrum disorders. *American journal of epidemiology*, 178(2), 209-220.

- Lyall, K., Schmidt, R. J., & Hertz-Picciotto, I. (2014). Maternal lifestyle and environmental risk factors for autism spectrum disorders. *International journal of epidemiology*, 43(2), 443-464.
- Marks AR, Harley K, Bradman A, Kogut K, Barr DB, Johnson C, et al. Organophosphate pesticide exposure and attention in young Mexican-American children: the CHAMACOS study. *Environ Health Perspect.*2010;118(12):1768–74.
- Messer, A. (2010). Mini-review: polybrominated diphenyl ether (PBDE) flame retardants as potential autism risk factors. *Physiology & behavior*, 100(3), 245-249.
- Meyer U, Yee BK, Feldon J (2007): The neurodevelopmental impact of prenatal infections at different times of pregnancy: The earlier the worse? *Neuroscientist* 13:241–256.
- Milberger, S., Biederman, J., Faraone, S. V., Chen, L., & Jones, J. (1996). Is maternal smoking during pregnancy a risk factor for attention deficit hyperactivity disorder in children? *The American Journal of Psychiatry*, 153, 1138–1142.
- Miller E, Craddock-Watson JE, Pollock TM (1982): Consequences of confirmed maternal rubella at successive stages of pregnancy. *Lancet* 320: 781–784.
- Miller MT, Strömland K (1999): Teratogen update: Thalidomide: A review, with a focus on ocular findings and new potential uses. *Teratology* 60:306 –321.
- Miller MT, Strömland K, Ventura L, Johansson M, Bandim JM, Gillberg C (2005): Autism associated with conditions characterized by developmental errors in early embryogenesis: A mini review. *Int J Dev Neurosci* 23:201–219.
- Miodovnik A, Engel SM, Canfield RL, Zhu C, Silva MJ, Calafat AM, Wolff MS. Endocrine disruptors and childhood social impairment. *Neurotoxicology*. 2011;32:261–267. [[PMCID free article](#)][[PubMed](#)] [[Google Scholar](#)]
- Mohamed, F. E. B., Zaky, E. A., El-Sayed, A. B., Elhossieny, R. M., Zahra, S. S., Salah Eldin, W., & Youssef, A. M. (2015). Assessment of hair aluminum, lead, and mercury in a

- sample of autistic Egyptian children: environmental risk factors of heavy metals in autism. *Behavioural neurology*, 2015.
- Moore SJ, Tumpenny P, Quinn A, Glover S, Lloyd DJ, Montgomery T, *et al.* (2000): A clinical study of 57 children with fetal anticonvulsant syndromes. *J Med Genet* 37:489–497.
- Moy SS, Nadler JJ, Magnuson TR, Crawley JN. Mouse models of autism spectrum disorders: the challenge for behavioral genetics. *Am J Medv Genet Part C (Semin Med Genet)*. 2006;142C:40–51.
- Napier, G., Lee, D., Robertson, C., Lawson, A., & Pollock, K.G. (2016). A model to estimate the impact of changes in MMR vaccine up take on inequalities in measles susceptibility in Scotland. *Statistical Methods in Medical Research*.
- Norman JE, Thong KJ, Baird DT (1991): Uterine contractility and induction of abortion in early pregnancy by misoprostol and mifepristone. *Lancet* 338:1233–1236.
- NTP-CERHR. NTP-CERHR expert panel report on the reproductive and developmental toxicity of BPA. CDC, DHSS; Washington, DC: 2007. <http://cerhr.niehs.nih.gov/chemicals/bisphenol/BPAFinalEPVF112607.pdf>. [Google Scholar]
- Palmer, R. F., Blanchard, S., Stein, Z., Mandell, D., & Miller, C. (2006). Environmental mercury release, special education rates, and autism disorder: an ecological study of Texas. *Health & Place*, 12(2), 203-209.
- Ploeger, A., Raijmakers, M. E., van der Maas, H. L., & Galis, F. (2010). The association between autism and errors in early embryogenesis: what is the causal mechanism?. *Biological psychiatry*, 67(7), 602-607.
- Population Council (2003): Misoprostol and teratogenicity: Reviewing the evidence: Report of a Meeting at the Population Council New York, New York, May 22, 2002. New York: The Population Council Inc.
- Rapin I. The autistic-spectrum disorder. *N Engl J Med* 2002; 347:302–303.

- Rauh V, Arunajadai S, Horton M, Perera F, Hoepner L, Barr DB, Whyatt R. Seven-year neurodevelopmental scores and prenatal exposure to chlorpyrifos, a common agricultural pesticide. *Environ Health Perspect*. 2011;119(8):1196–201.
- Rauh VA, Garfinkel R, Perera FP, Andrews HF, Hoepner L, Barr DB, et al. Impact of prenatal chlorpyrifos exposure on neurodevelopment in the first 3 years of life among inner-city children. *Pediatrics*. 2006;118(6):e1845–59.
- Rice D, Barone S Jr (2000): Critical periods of vulnerability for the developing nervous system: Evidence from humans and animal models. *Environ Health Perspect* 108:511–533.
- Ricceri L, Moles A, Crawley J. Behavioral phenotyping of mouse models of neurodevelopmental disorders: relevant social behavior patterns across the life span. *Behav Brain Res*. 2007;176(1):40–52.
- Richter CA, Birnbaum LS, Farabollini F, Newbold RR, Rubin BS, Talsness CE, Vandenberg JG, Walser-Kuntz DR, vom Saal FS. In vivo effects of bisphenol A in laboratory rodent studies. *Reproductive Toxicology*. 2007;24:199–224. [[PMC free article](#)] [[PubMed](#)] [[Google Scholar](#)]
- Roberts, E. M., English, P. B., Grether, J. K., Windham, G. C., Somberg, L., & Wolff, C. (2007). Maternal residence near agricultural pesticide applications and autism spectrum disorders among children in the California Central Valley. *Environmental health perspectives*, 115(10), 1482-1489.
- Rose, S., Melnyk, S., Savenka, A., Hubanks, A., Jernigan, S., Cleves, M., & James, S. J. (2008). The frequency of polymorphisms affecting lead and mercury toxicity among children with autism. *Am J Biochem Biotech*, 4(2), 85-94.
- Rubin BS. Bisphenol A: an endocrine disruptor with widespread exposure and multiple effects. *Journal of Steroid Biochemistry & Molecular Biology*. 2011;127:27–34. [[PubMed](#)] [[Google Scholar](#)]

- Sander K (1983): The evolution of patterning mechanisms: Gleaning from insect embryogenesis and spermatogenesis. In: Goodwin BC, Holder N, Wylie CC, editors. *Development and Evolution*. Cambridge, United Kingdom: Cambridge University Press, 137–159.
- Sadowski, R. N., Wise, L. M., Park, P. Y., Schantz, S. L., & Juraska, J. M. (2014). Early exposure to bisphenol A alters neuron and glia number in the rat prefrontal cortex of adult males, but not females. *Neuroscience*, 279, 122-131.
- Schmidt, R. J., Hansen, R. L., Hartiala, J., Allayee, H., Schmidt, L. C., Tancredi, D. J. & Hertz-Picciotto, I. (2011). Prenatal vitamins, one-carbon metabolism gene variants, and risk for autism. *Epidemiology (Cambridge, Mass.)*, 22(4), 476.
- Sealey, L. A., Hughes, B. W., Sriskanda, A. N., Guest, J. R., Gibson, A. D., Johnson-Williams, L., ... & Bagasra, O. (2016). Environmental factors in the development of autism spectrum disorders. *Environment international*, 88, 288-298.
- Shaw, C.A., Li, D., Tomljenovic, L., 2014b. Are there negative CNS impacts of aluminum adjuvants used in vaccines and immunotherapy? *Immunotherapy* 6, 1055–1071.
- Shaw, C.A., Sheth, S., Li, D., et al., 2014a. Etiology of autism spectrum disorders: genes, environment, or both? *OA Autism*. 2, 11.
- Shea, A. K., & Steiner, M. (2008). Cigarette smoking during pregnancy. *Nicotine & Tobacco Research*, 10, 267–278
- Shelton, J. F., Hertz-Picciotto, I., & Pessah, I. N. (2012). Tipping the balance of autism risk: potential mechanisms linking pesticides and autism. *Environmental health perspectives*, 120(7), 944-951.
- Sjodin A, Hagmar L, Klasson-Wehler E, Kronholm-Dlab K, Jakobsson E, Bergman O. Flame retardant exposure: Polybrominated diphenyl ethers in blood from Swedish workers. *Environ. Health Perspect.* 1999; 107(8):643–648. [PubMed: 10417362]

- Stein, T. P., Schluter, M. D., Steer, R. A., Guo, L., & Ming, X. (2015). Bisphenol A exposure in children with autism spectrum disorders. *Autism Research*, 8(3), 272-283.
- Sterberg R. J. (1987). An unified theoretical perspective on autism. In Cohen D. J., Donnellan A. M., Paul R., Handbook of Autism and Pervasive Developmental Disorders. New York: Wiley, 690-696
- Strömmland K, Nordin V, Miller M, Akerström B, Gillberg C (1994): Autism in thalidomide embryopathy: A population study. *Dev Med Child Neurol* 36:351–356
- Sudarshan A, Goldie WD (1985): The spectrum of congenital facial diplegia (Moebius syndrome). *Pediatr Neurol* 1:180 –184
- Schechter A, Pavuk M, Paepke O, Ryan JJ, Birnbaum L, Rosen R. Polybrominated diphenyl ethers (PBDEs) in U.S. mothers' milk. *Environ. Health Perspect.* 2003; 111(14):1723–1729. [PubMed: 14594622]
- Schmidt RJ, Hansen RL, Hartiala J et al. Prenatal vitamins, one-carbon metabolism gene variants, and risk for autism. *Epidemiology* 2011;22:476–85.
- Schultz ST. Does thimerosal or other mercury exposure increase the risk for autism?. *Acta Neurob Exp* 2010;70:187-195.
- Surén, P., Roth, C., Bresnahan, M., Haugen, M., Hornig, M., Hirtz, D., ... & Schjøberg, S. (2013). Association between maternal use of folic acid supplements and risk of autism spectrum disorders in children. *Jama*, 309(6), 570-577.
- Tellez-Rojo, M.M., D.C. Bellinger, C. Arroyo- Quiroz, H. Lamadrid-Figueroa, A. Mercado-Garcia, L. Schnaas-Arrieta, R.O. Wright, M. Hernandez-Avila and H. Hu, 2006. Longitudinal associations between blood lead concentrations lower than 10 microg/dL and neurobehavioral development in environmentally exposed children in Mexico City. *Pediatr.*, 118: e323-e330.

Thayer KA, Heindel JJ, Bucher JR, Gallo MA. Role of environmental chemicals in diabetes and obesity: a National Toxicology Program workshop review. *Environ Health Perspect.* 2012;120:779–789. [[PMC free article](#)] [[PubMed](#)] [[Google Scholar](#)]

Tran, P. L., Lehti, V., Lampi, K. M., Helenius, H., Suominen, A., Gissler, M., ... & Sourander, A. (2013). Smoking during Pregnancy and Risk of Autism Spectrum Disorder in a Finnish National Birth Cohort. *Paediatric and perinatal epidemiology*, 27(3), 266-274.

Ueda K, Nishida Y, Oshima K, Shepard TH (1979): Congenital rubella syndrome: Correlation of gestational age at time of maternal rubella with type of defect. *J Pediatr* 94:763–765.

Volkmar FR and Pauls D. Autism. *Lancet* 2003. **362**(9390): p. 1133-41.

Vom Saal FS, Nagel SC, Coe BL, Angle BM, Taylor JA. The estrogenic endocrine disrupting chemical bisphenol A (BPA) and obesity. *Molecular & Cellular Endocrinology.* 2012;354:74–84. [[PMC free article](#)] [[PubMed](#)] [[Google Scholar](#)]

Wang Y, Zhang Y, Ji L, Hu Y, Zhang J, Wang C, et al. Prenatal and postnatal exposure to organophosphate pesticides and childhood neurodevelopment in Shandong, China. *Environ Int.* 2017;108:119–26.

Whitehouse, A. J., Holt, B. J., Serralha, M., Holt, P. G., Hart, P. H., & Kusel, M. M. (2013). Maternal vitamin D levels and the autism phenotype among offspring. *Journal of autism and developmental disorders*, 43(7), 1495-1504.

Whyatt RM, Garfinkel R, Hoepner LA, Andrews H, Holmes D, Williams MK, et al. A biomarker validation study of prenatal chlorpyrifos exposure within an inner-city cohort during pregnancy. *Environ Health Perspect.* 2009;117(4):559–67

Wing, L. (1997). *Syndromes of autism and atypical development.*

Wing, L. (2000). Το αυτιστικό φάσμα: Ένας οδηγός για γονείς και επαγγελματίες (μτφ. Π. Πρώϊος). Ελληνική Εταιρία Προστασίας Αυτιστικών Ατόμων



Witter FR, Zimmerman AW, Reichmann JP, Connors SL. In utero beta 2 adrenergic agonist exposure and adverse neurophysiologic and behavioral outcomes. *Am J Obstet Gynecol.* 2009;201:553\_9.

Wolstenholme JT, Edwards M, Shetty SR, Gatewood JD, Taylor JA, Rissman EF, Connelly JJ. Gestational exposure to bisphenol A produces transgenerational changes in behaviors and gene expression. *Endocrinology.* 2012;153:3828–3838. [[PMC free article](#)] [[PubMed](#)] [[Google Scholar](#)]

Wong, S., & Giulivi, C. (2016). Autism, mitochondria and polybrominated diphenyl ether exposure. *CNS & Neurological Disorders-Drug Targets (Formerly Current Drug Targets-CNS & Neurological Disorders)*, 15(5), 614-623

Worth, S. (2005). *Autistic Spectrum Disorders*. New York: Continuum International Publishing Group.

Young JG, Eskenazi B, Gladstone EA, Bradman A, Pedersen L, Johnson C, et al. Association between in utero organophosphate pesticide exposure and abnormal reflexes in neonates. *Neurotoxicology.* 2005;26(2):199–209.

Zerrate MC, Pletnikov M, Connors SL, Vargas DL, Seidler FJ, Zimmerman AW, et al. Neuroinflammation and behavioral abnormalities after neonatal terbutaline treatment in rats: Implications for autism. *J Pharmacol Exp Ther.* 2007;322: 16\_22.

Zerbo, O., Qian, Y., Yoshida, C., Grether, J. K., Van de Water, J., & Croen, L. A. (2015). Maternal infection during pregnancy and autism spectrum disorders. *Journal of autism and developmental disorders*, 45(12), 4015-4025.

Αλεξίου Χ.(Μάιος 2003 ). Ζώντας με τον αυτισμό. Παρουσιάστηκε τη 2<sup>η</sup> μέρα του Διεθνούς Επιστημονικού Συμποσίου του Συλλόγου Γονέων Κηδεμόνων και φίλων Αυτιστικών Ατόμων Ν. Λάρισας, Λάρισα.

- Βαρδαλάκη, Ε., Κουρεμένου, Α., & Φατούρου, Ε. (2014). *Αυτισμός και σύνδρομο Asperger*. Ανώτατο Τεχνολογικό Εκπαιδευτικό Ίδρυμα Ηπείρου Σχολή Επαγγελματιών Υγείας και Πρόνοιας Τμήμα Λογοθεραπείας, Ιωάννινα
- Βολάκη, Κ. (2012). *Μοριακή μελέτη ασθενών με αυτιστική συμπεριφορά* (Doctoral dissertation, Εθνικό και Καποδιστριακό Πανεπιστήμιο Αθηνών (ΕΚΠΑ). Σχολή Επιστημών Υγείας. Τμήμα Ιατρικής. Τομέας Υγείας Μητέρας και Παιδιού. Εργαστήριο Ιατρικής Γενετικής)
- Γενά, Α. (2002). *Αυτισμός και διάχυτες αναπτυξιακές διαταραχές: αξιολόγηση, διάγνωση, αντιμετώπιση.*
- Γκονέλα, Ε (2006). *Αυτισμός, αίνιγμα και πραγματικότητα από τη θεωρητική προσέγγιση στην εκπαιδευτική παρέμβαση.* Αθήνα: Οδυσσεάς.
- Γκρέμου, Μ., Κέντρου, Ε., 2016. *Αυτισμός: μια διάχυτη αναπτυξιακή διαταραχή: πολυπαραγοντική προσέγγιση αναπτυξιακής διαταραχής αυτιστικού φάσματος.* Πτυχιακή εργασία. Ιωάννινα. Τ.Ε.Ι. Ηπείρου. Σχολή Επαγγελματιών Υγείας & Πρόνοιας. Τμήμα Λογοθεραπείας
- Καλτέκη, Π., Κύρκου, Α. Μ., & Μπίκα, Κ. (2017). *Πολυπαραγοντική προσέγγιση αναπτυξιακών διαταραχών σε επίπεδο διάγνωσης: μελέτη περίπτωσης παιδιών 3-7 ετών με διαταραχή νοητικής υστέρησης και φάσματος αυτισμού.* Τ.Ε.Ι. Ηπείρου, Σχολή Επαγγελματιών Υγείας και Πρόνοιας, Τμήμα Λογοθεραπείας, Ιωάννινα
- Κυπριωτάκης, Α. (2003). *Τα αυτιστικά παιδιά και η αγωγή τους.* Ηράκλειο: εκδόσεις: Γ. Κ Παπαγεωργίου.
- Κωνστανταρέα Μ.(2001). *Παιδικός αυτισμός.* Στων:Τσιάντης Γ., Μανωλόπουλος Σ.(2001).*Σύγχρονα θέματα Παιδοψυχιατρικής.* Αθήνα:Εκδ. Καστανιώτη
- Νότας, Σ. (2013). *Διαγνωστικά κριτήρια για τις Διαταραχές του Φάσματος του Αυτισμού.*  
Ανακτήθηκε 25/04/2019 από : <https://autismhellas.gr/fasma/docs/1.htm>

Χαράλαμπος, Δ. (2017). Τοξικοί παράγοντες και αυτισμός. *Rostrum of Asclepius/Vima tou Asklipeiou*, 16(3).

Χατζηπανταζής, Β. (2014). Αυτισμός.

<http://www.enaplotiti.gr/ea/index.php/socials/other/3085-theories-of-the-autistic-mind>