

ЛИТЕРАТУРА / REFERENCES

1. Cooper E.A. On the relations of phenol and meta-cresol to proteins; a contribution to our knowledge of the mechanism of disinfection. *Biochem J.* 1912; 6 (4): 362–87. <https://doi.org/10.1042/bj0060362>.
2. Reddish G.F. The resistance to phenol of staphylococcus aureus. *Am J Public Health.* 1925; 15 (6): 534–8. <https://doi.org/10.2105/ajph.15.6.534>.
3. Berger H., Wyss O. Studies on bacterial resistance to inhibition and killing by phenol. *J Bacteriol.* 1953; 65 (1): 103–10. doi: <https://doi.org/10.1128/jb.65.1.103-110.1953>.
4. Slonim D., Diawara S.M., Brázdová R. Effect of 1 percent phenol on several bacterial and viral species. *J Hyg Epidemiol Microbiol Immunol.* 1969; 13 (3): 313–20.
5. Gwatkin R. Phenol as a preservative of brain tissue. *Can J Comp Med Vet Sci.* 1942; 6 (7): 191–6.
6. Farrell W.A. The Therapeutic value of phenol. *Can Med Assoc J.* 1936; 34 (1): 98.
7. Gupta S., Ashrith G., Chandra D., et al. Acute phenol poisoning: a life-threatening hazard of chronic pain relief. *Clin Toxicol.* 2008; 46 (3): 250–3. <https://doi.org/10.1080/15563650701438888>.
8. Reid W. The relief of pain in osteitis deformans (Paget's disease of bone) by phenol injection of the sympathetic chain. *Scott Med J.* 1960; 5: 71–5. <https://doi.org/10.1177/003693306000500204>.
9. Lifton R.J. The Nazi doctors: medical killing and the psychology of genocide. Basic Books; 1988: 576 pp.
10. Sykes G., Hooper M.C. Phenol as the preservative in insulin injections. *J Pharm Pharmacol.* 1954; 6 (8): 552–7. <https://doi.org/10.1111/j.2042-7158.1954.tb10986.x>.
11. Valkova N., Lépine F., Valeanu L., et al. Hydrolysis of 4-hydroxybenzoic acid esters (parabens) and their aerobic transformation into phenol by the resistant *Enterobacter cloacae* strain EM. *Appl Environ Microbiol.* 2001; 67 (6): 2404–9. <https://doi.org/10.1128/AEM.67.6.2404-2409.2001>.
12. Fransway A.F., Fransway P.J., Belsito D.V., Yiannias J.A. Paraben toxicology. *Dermatitis.* 2019; 30 (1): 32–45. <https://doi.org/10.1097/DER.0000000000000428>.
13. Torshin I.Yu. The study of the solvability of the genome annotation problem on sets of elementary motifs. *Pattern Recognit Image Anal.* 2011; 21: 652–62. <https://doi.org/10.1134/S1054661811040171>.
14. Журавлёв Ю.И., Рудаков К.В., Торшин И.Ю. Алгебраические критерии локальной разрешимости и регулярности как инструмент исследования морфологии аминокислотных последовательностей. *Труды Московского физико-технического института.* 2011; 3 (4): 45–54.
15. Zhuravlev Yu.I., Rudakov K.V., Torshin I.Yu. Algebraic criteria of local solvability and regularity as a tool for studying the morphology of amino acid sequences. *Proceedings of Moscow Institute of Physics and Technology.* 2011; 3 (4): 45–54 (in Russ.).
16. Bennett I.L. Jr., James D.F., Golden A. Severe acidosis due to phenol poisoning; report of two cases. *Ann Intern Med.* 1950; 32 (2): 324–7. <https://doi.org/10.7326/0003-4819-32-2-324>.
17. Mancuso T.F. Industrial poisoning: phenol and related compounds. *Ohio State Med J.* 1955; 51 (7): 672.
18. Паспорт безопасности. Фенол. Версия 18.0. URL: <https://www.borealisgroup.com/storage/Datasheets/PHENOL-MSDS-RU-RU-V18-SDS-RU-5110-10024772.pdf> (дата обращения 15.06.2024). Safety data sheet. Phenol. Version 18.0. Available at: <https://www.borealisgroup.com/storage/Datasheets/PHENOL-MSDS-RU-RU-V18-SDS-RU-5110-10024772.pdf> (in Russ.) (accessed 15.06.2024).
19. Propylparaben safety data sheets. Available at: <https://www.echemi.com/sds/propylparaben-pd20150901017.html> (accessed 15.06.2024).
20. Ansel H.C., Cadwallader D.E. Hemolysis of erythrocytes by antibacterial preservatives. *J Pharm Sci.* 1964; 53: 169–72. <https://doi.org/10.1002/jps.2600530213>.
21. Ceresa C. Professional phenol dermatitis. *Med Lav.* 1948; 39 (3): 80–2.
22. Lin T.M., Lee S.S., Lai C.S., Lin S.D. Phenol burn. *Burns.* 2006; 32 (4): 517–21. <https://doi.org/10.1016/j.burns.2005.12.016>.
23. Warner M.A., Harper J.V. Cardiac dysrhythmias associated with chemical peeling with phenol. *Anesthesiology.* 1985; 62 (3): 366–7. <https://doi.org/10.1097/0000542-198503000-00030>.
24. Weber M., Weber M., Kleine-Boymann M. Phenol. In: Ullmann's encyclopedia of industrial chemistry. Wiley; 2003: 589–604. https://doi.org/10.1002/14356007.a19_299.pub2.
25. Castelain F., Castelain M. Parabens: a real hazard or a scare story? *Eur J Dermatol.* 2012; 22 (6): 723–7. <https://doi.org/10.1684/ejd.2012.1835>.
26. Vilaplana J., Romaguera C. Contact dermatitis from parabens used as preservatives in eyedrops. *Contact Dermatitis.* 2000; 43 (4): 248.
27. Veien N.K., Hattel T., Laurberg G. Oral challenge with parabens in paraben-sensitive patients. *Contact Dermatitis.* 1996; 34 (6): 433. <https://doi.org/10.1111/j.1600-0536.1996.tb02252.x>.
28. Kajimoto Y., Rosenberg M.E., Kyttä J., et al. Anaphylactoid skin reactions after intravenous regional anaesthesia using 0.5% prilocaine with or without preservative – a double-blind study. *Acta Anaesthesiol Scand.* 1995; 39 (6): 782–4. <https://doi.org/10.1111/j.1399-6576.1995.tb04170.x>.
29. Nesbit R.M., Burk L.B., Olsen N.S. Blood level of phenol in uremia. *Arch Surg (1920).* 1946; 53: 483–8. <https://doi.org/10.1001/archsurg.1946.01230060491013>.
30. Warren H.L. Blood phenol in renal insufficiency. *J Urol.* 1954; 71 (2): 134–43. [https://doi.org/10.1016/S0022-5347\(17\)67765-6](https://doi.org/10.1016/S0022-5347(17)67765-6).
31. Ruedemann R., Deimann W.B. Blood phenol level after topical application of phenol containing preparations. *J Am Med Assoc.* 1953; 152 (6): 506–9. <https://doi.org/10.1001/jama.1953.03690060022008>.
32. Sun M., Li S., Zhou X.L., et al. Association of urinary phenol concentration and blood biochemical indices in coke oven workers. *Zhonghua Lao Dong Wei Sheng Zhi Ye Bing Za Zhi.* 2020; 38 (6): 440–3 (in Chinese). <https://doi.org/10.3760/cma.j.cn121094-20191212-00561>.
33. Krasawa M., Stanfield J.K., Yanagisawa S., et al. Whole-cell transformation of benzene to phenol catalysed by intracellular cytochrome P450BM3 activated by external additives. *Angew Chem Int Ed Engl.* 2018; 57 (38): 12264–69. <https://doi.org/10.1002/anie.201804924>.
34. Jindrichova J. Relation between the phenol content of the urine and the benzene content of the atmosphere, as verified by field work (in Czech). *Prac Lek.* 1958; 10 (2): 131–4.
35. Eastmond D.A., Smith M.T., Ruza L.O., Ross D. Metabolic activation of phenol by human myeloperoxidase and horseradish peroxidase. *Mol Pharmacol.* 1986; 30 (6): 674–9.
36. Prusakiewicz J.J., Harville H.M., Zhang Y., et al. Parabens inhibit human skin estrogen sulfotransferase activity: possible link to paraben estrogenic effects. *Toxicology.* 2007; 232 (3): 248–56. <https://doi.org/10.1016/j.tox.2007.01.010>.
37. Ahn H.J., An B.S., Jung E.M., et al. Parabens inhibit the early phase of folliculogenesis and steroidogenesis in the ovaries of neonatal rats. *Mol Reprod Dev.* 2012; 79 (9): 626–36. <https://doi.org/10.1002/mrd.22070>.
38. Chen G., Niu X., Chen Y., et al. Estrogenic disruption effects and formation mechanisms of transformation products during photolysis of preservative parabens. *Sci Total Environ.* 2024; 924: 171608. <https://doi.org/10.1016/j.scitotenv.2024.171608>.
39. Pollock T., Weaver R.E., Ghasemi R., deCatanzaro D. Butyl paraben and propyl paraben modulate bisphenol A and estradiol concentrations in female and male mice. *Toxicol Appl Pharmacol.* 2017; 325: 18–24. <https://doi.org/10.1016/j.taap.2017.04.001>.
40. Liu X., Matsushima A., Nakamura M., et al. Fine spatial assembly for construction of the phenol-binding pocket to capture bisphenol A in the human nuclear receptor estrogen-related receptor γ . *J Biochem.* 2012; 151 (4): 403–15. <https://doi.org/10.1093/jb/mvs008>.
41. Chen J., Ahn K.C., Gee N.A., et al. Antiandrogenic properties of parabens and other phenolic containing small molecules in personal care products. *Toxicol Appl Pharmacol.* 2007; 221 (3): 278–84. <https://doi.org/10.1016/j.taap.2007.03.01541>.
42. Handa O., Kokura S., Adachi S., et al. Methylparaben potentiates UV-induced damage of skin keratinocytes. *Toxicology.* 2006; 227 (1–2): 62–72. <https://doi.org/10.1016/j.tox.2006.07.018>.
43. Alwadi D., Felty Q., Roy D., et al. Environmental phenol and paraben

- exposure risks and their potential influence on the gene expression involved in the prognosis of prostate cancer. *Int J Mol Sci.* 2022; 23 (7): 3679. <https://doi.org/10.3390/ijms23073679>.
43. Harvey P.W., Everett D.J. Significance of the detection of esters of p-hydroxybenzoic acid (parabens) in human breast tumours. *J Appl Toxicol.* 2004; 24 (1): 1–4. <https://doi.org/10.1002/jat.957>.
44. McGrath K.G. An earlier age of breast cancer diagnosis related to more frequent use of antiperspirants/deodorants and underarm shaving. *Eur J Cancer Prev.* 2003; 12 (6): 479–85. <https://doi.org/10.1097/00008469-200312000-00006>.
45. Gopalakrishnan K., Teitelbaum S.L., Lambertini L., et al. Changes in mammary histology and transcriptome profiles by low-dose exposure to environmental phenols at critical windows of development. *Environ Res.* 2017; 152: 233–43. <https://doi.org/10.1016/j.envres.2016.10.021>.
46. Rosen Vollmar A.K., Weinberg C.R., Baird D.D., et al. Urinary phenol concentrations and fecundability and early pregnancy loss. *Hum Reprod.* 2023; 38 (1): 139–55. <https://doi.org/10.1093/humrep/deac230>.
47. Ouidir M., Cissé A.H., Botton J., et al. Fetal and infancy exposure to phenols, parabens, and phthalates and anthropometric measurements up to 36 months, in the longitudinal SEPAGES cohort. *Environ Health Perspect.* 2024; 132 (5): 57002. <https://doi.org/10.1289/EHP1364448>.
48. Berger K., Coker E., Rauch S., et al. Prenatal phthalate, paraben, and phenol exposure and childhood allergic and respiratory outcomes: evaluating exposure to chemical mixtures. *Sci Total Environ.* 2020; 725: 138418. <https://doi.org/10.1016/j.scitotenv.2020.138418>.
49. Zhao H., Zheng Y., Zhu L., et al. Paraben exposure related to purine metabolism and other pathways revealed by mass spectrometry-based metabolomics. *Environ Sci Technol.* 2020; 54 (6): 3447–54. <https://doi.org/10.1021/acs.est.9b07634>.
50. Nakiwala D., Noyes P.D., Faure P., et al. Phenol and phthalate effects on thyroid hormone levels during pregnancy: relying on in vitro assays and adverse outcome pathways to inform an epidemiological analysis. *Environ Health Perspect.* 2022; 130 (11): 117004. <https://doi.org/10.1289/EHP10239>.
51. Aker A.M., Johns L., McElrath T.F., et al. Associations between maternal phenol and paraben urinary biomarkers and maternal hormones during pregnancy: a repeated measures study. *Environ Int.* 2018; 113: 341–9. <https://doi.org/10.1016/j.envint.2018.01.006>.
52. Guo J., Wu C., Zhang J., et al. Maternal and childhood urinary phenol concentrations, neonatal thyroid function, and behavioral problems at 10 years of age: the SMBCS study. *Sci Total Environ.* 2020; 743: 140678. <https://doi.org/10.1016/j.scitotenv.2020.140678>.
53. Oskar S., Balalian A.A., Stingone J.A. Identifying critical windows of prenatal phenol, paraben, and pesticide exposure and child neurodevelopment: findings from a prospective cohort study. *Sci Total Environ.* 2024; 920: 170754. <https://doi.org/10.1016/j.scitotenv.2024.170754>.
54. Barkoski J.M., Busgang S.A., Bixby M., et al. Prenatal phenol and paraben exposures in relation to child neurodevelopment including autism spectrum disorders in the MARBLES study. *Environ Res.* 2019; 179 (Pt A): 108719. <https://doi.org/10.1016/j.envres.2019.108719>.
55. Tung C.J., Chen M.H., Lin C.C., Chen P.C. Association between parabens exposure and neurodevelopment in children. *Environ Int.* 2024; 188: 108671. <https://doi.org/10.1016/j.envint.2024.108671>.
56. Lara-Valderrábano L., Rocha L., Galván E.J. Propylparaben reduces the excitability of hippocampal neurons by blocking sodium channels. *Neurotoxicology.* 2016; 57: 183–93. <https://doi.org/10.1016/j.neuro.2016.09.019>.
57. Michałowicz J., Wluka A., Cyrkler M., et al. Phenol and chlorinated phenols exhibit different apoptotic potential in human red blood cells (in vitro study). *Environ Toxicol Pharmacol.* 2018; 61: 95–101. <https://doi.org/10.1016/j.etap.2018.05.014>.
58. Merola C., Gaioni G., Bertolucci C., et al. Embryonic and larval exposure to propylparaben induces developmental and long-term neurotoxicity in zebrafish model. *Sci Total Environ.* 2024; 912: 168925. <https://doi.org/10.1016/j.scitotenv.2023.168925>.
59. Nagar Y., Thakur R.S., Parveen T., et al. Toxicity assessment of parabens in *Caenorhabditis elegans*. *Chemosphere.* 2020; 246: 125730. <https://doi.org/10.1016/j.chemosphere.2019.125730>.
60. Bereketoglu C., Pradhan A. Comparative transcriptional analysis of methylparaben and propylparaben in zebrafish. *Sci Total Environ.* 2019; 671: 129–39. <https://doi.org/10.1016/j.scitotenv.2019.03.358>.
61. Martins F.C., Oliveira M.M., Gaivão I., et al. The administration of methyl and butyl parabens interferes with the enzymatic antioxidant system and induces genotoxicity in rat testis: possible relation to male infertility. *Drug Chem Toxicol.* 2024; 47 (3): 322–9. <https://doi.org/10.1080/01480545.2023.2176512>.
62. Samarasinghe S.V.A.C., Krishnan K., Naidu R., et al. Parabens generate reactive oxygen species in human spermatozoa. *Andrology.* 2018; 6 (4): 532–41. <https://doi.org/10.1111/andr.12499>.
63. Leppert B., Strunz S., Seiwert B., et al. Maternal paraben exposure triggers childhood overweight development. *Nat Commun.* 2020; 11 (1): 561. <https://doi.org/10.1038/s41467-019-14202-1>.
64. Sievers O., Jannes L. Chemical control of the phenol contents of vaccines and serum preparations. *Acta Pathol Microbiol Scand.* 1945; 22 (2): 204. <https://doi.org/10.1111/j.1699-0463.1945.tb05043.x>.
65. Banic S. Injurious effect of phenol on antirabies vaccine. *Z Immun Exp Ther.* 1953; 110 (6): 502–5.
66. Инструкция по медицинскому применению препарата Церебролизин®. Государственный реестр лекарственных средств. URL: https://grls.rosminzdrav.ru/Grls_View_v2.aspx?routingGuid=f1b69bf9-f160-48e0-9d08-03cadc1893dd (дата обращения 15.06.2024). Instructions for the medical use of the drug Cerebrolysin®. State Register of Medicines. Available at: https://grls.rosminzdrav.ru/Grls_View_v2.aspx?routingGuid=f1b69bf9-f160-48e0-9d08-03cadc1893dd (in Russ.) (accessed 15.06.2024).
67. Громова О.А., Торшин И.Ю., Зайчик Б.Ц. и др. О различиях в стандартизации лекарственных препаратов на основе экстрактов хондроитина сульфата. *ФАРМАКОЭКОНОМИКА. Современная фармакоэкономика и фармакоэпидемиология.* 2021; 14 (1): 50–62. <https://doi.org/10.17749/2070-4909/farmakoeconomika.2021.083>.
68. Gromova O.A., Torshin I.Yu., Zaychik B.Ts., et al. Differences in the standardization of medicinal products based on extracts of chondroitin sulfate. *FARMAKOEKONOMIKA. Sovremennaya farmakoeconomika i farmakoepidemiologiya / FARMAKOEKONOMIKA. Modern Pharmacoeconomics and Pharmacoepidemiology.* 2021; 14 (1): 50–62 (in Russ.). <https://doi.org/10.17749/2070-4909/farmakoeconomika.2021.083>.
68. Budavari S. (Ed.) The Merck Index: an encyclopedia of chemicals, drugs, and biologicals. 11th ed. Merck; 1989.
69. Brühne F., Wright L. Benzyl alcohol. In: Ullmann's encyclopedia of industrial chemistry. Wiley; 2007: 7–8. https://doi.org/10.1002/14356007.a04_001.
70. Торшин И.Ю., Громова О.А., Кобалава Ж.Д. О репрессиях ω-3 полиненасыщенных жирных кислот адептами доказательной медицины. *ФАРМАКОЭКОНОМИКА. Современная фармакоэкономика и фармакоэпидемиология.* 2019; 12 (2): 91–114. <https://doi.org/10.17749/2070-4909.2019.12.2.91-114>.
- Torshin I.Yu., Gromova O.A., Kobalava Zh.D. Concerning the “repression” of ω-3 polyunsaturated fatty acids by adepts of evidencebased medicine. *FARMAKOEKONOMIKA. Sovremennaya farmakoeconomika i farmakoepidemiologiya / FARMAKOEKONOMIKA. Modern Pharmacoeconomics and Pharmacoepidemiology.* 2019; 12 (2): 91–114 (in Russ.). <https://doi.org/10.17749/2070-4909.2019.12.2.91-114>.

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