

BIBLIOGRAPHY

Bibliography

1. Chibuike, G. U. & Obiora, S. C., Heavy metal polluted soils: effect on plants and bioremediation methods, *Appl. Environ. Soil Sci.* **12**, 708--752, 2014.
2. Flora, S. J. S., et al. Heavy metal induced oxidative stress & its possible reversal by chelation therapy, *Indian J. Med. Res.* **128**, 501--523, 2008.
3. Masood, F., & Malik. A. Biosorption of metal ions from aqueous solution and tannery effluent by *Bacillus* sp. FM1, *J. Environ. Sci. Health.* **46**, 1667--1674, 2011.
4. Nourbakhsh, M., et al., Biosorption of Cr⁶⁺, Pb²⁺ and Cu²⁺ ions in industrial waste water on *Bacillus* sp, *Chem. Eng. J.* **85**, 351--355, 2002.
5. Flora, S. J. S., et.al. Response of lead-induced oxidative stress and alterations in biogenic amines in different rat brain regions to combined administration of DMSA and MiADMSA, *Chem. Biol. Interact.* **170**, 209--20, 32.
6. Chen, F., et al. Carcinogenic metals and NF-kappa B activation, *Mol. Cell Biochem.* **222**, 159--71, 2001
7. Stohs, S. J. & Bagchi, D. Oxidative mechanisms in the toxicity of metal-ions, *Free. Rad. Biol. Med.* **18**, 321--36, 1995.
8. Brennan, P. A., et al. Neurotransmitter release in the accessory olfactory bulb during and after the formation of an olfactory memory in mice, *Neuroscience* **69**, 1075--86, 1995.
9. Leonard, S. S., et al. Metal-induced oxidative stress and signal transduction, *Free Rad. Biol. Med.* **37**, 1921--42, 2004.
10. Biro, B., et al. Metal sensitivity of some symbiotic N₂-fixing bacteria and *Pseudomonas* strains, *Acta Biol. Hung.* **46**, 9--16, 1995.
11. Darbre, P. D. Metalloestrogens: an emerging class of inorganic xenoestrogens with potential to add to the oestrogenic burden of the human breast, *J. Appl. Toxicol.* **26**, 191--197, 2006.

12. Martin, M. B., et al. Estrogen-like activity of metals in MCF-7 breast cancer cells, *Endocrinol.* **144**, 2425--2436, 2003.
13. Probst, A. V., et al. Epigenetic inheritance during the cell cycle, *Nat. Rev. Mol. Cell Biol.* **10**, 192--206, 2009.
14. Karaczyn, A. A., et al. Ni (II) affects ubiquitination of core histones H2B and H2A, *Exp. Cell Res.* **312**, 3252--9, 2006.
15. Karaczyn, A. A., et al. Deamidation and oxidation of histone H2B in cells cultured with nickel (II), *Chem. Res. Toxicol.* **18**, 1934--42, 2005.
16. Gibb, H. J., et al. Lung cancer among workers in chromium chemical production, *Am. J. Ind. Med.* **38**, 115--26, 2000.
17. Shi, H., et al. Oxidative stress and apoptosis in metal ion-induced carcinogenesis, *Free Radic. Biol. Med.* **37**, 582--93, 2004.
18. Zhitkovich, A. Importance of chromium-DNA adducts in mutagenicity and toxicity of chromium (VI), *Chem. Res. Toxicol.* **18**, 3--11, 2005.
19. Morgan, L. G. & Usher, V. Health problems associated with nickel refining and use, *Ann. Occup. Hyg.* **38**, 189--98, 1994.
20. Fletcher, G. G., et al. Toxicity, uptake and mutagenicity of particulate and soluble nickel compounds, *Environ. Health Perspect.* **102**, 69--79, 1994.
21. Natalie, B., et al. Role of Cadmium and Nickel in Estrogen Receptor Signaling and Breast Cancer: Metalloestrogens or Not?, *J. Environ. Sci. Health C. Environ. Carcinog. Ecotoxicol. Rev.* **30**, 189--224, 2012.
22. Hussein, H., et al. Biosorption of heavy metals from waste water using *Pseudomonas* sp, *Electron. J. Biotechnol.* **1**, 38--46, 2004.
23. Nies, D.H. and Silver, S. Ion efflux systems involved in bacterial metal resistances, *J. Ind. Microbiol.* **14**, 189--199, 1995.
24. Blake, R. C., et al. Chemical transformation of toxic metals by a *Pseudomonas* strain from a toxic waste site, *Environ. Toxicol. Chem.* **12**, 1365--1376, 1993.

25. Etelvina, M. A. P. F., et al. Cadmium tolerance plasticity in *Rhizobium leguminosorum* bv. *viciae*: glutathione as a detoxifying agent, *Can. J. Microbiol.* **51**, 7--14, 2005.
26. Silver, S. and Phung, L. T. Bacterial heavy metal resistances: new surprises, *Annu. Rev. Microbiol.*, **50**, 753--789, 1996.
27. Archibald, F. S. & Duong, M. N. Manganese acquisition by *Lactobacillus plantarum*, *J. Bacteriol.* **158**, 1--8, 1984.
28. Burke, B. E. & Pfister, R. M. Cadmium transport by a Cd²⁺- sensitive and a Cd²⁺- resistant strain of *Bacillus subtilis*, *Can. J. Microbiol.* **32**, 539--542, 1986.
29. Tynecka, Z., et al. Reduced cadmium transport determined by a resistance plasmid in *Staphylococcus aureus*, *J. Bacteriol.* **147**, 305--312, 1981.
30. Solioz, M., et al. Responses of Lactic Acid Bacteria to Heavy Metal Stress, in *Stress Responses of Lactic Acid Bacteria*, 1st ed., E. Tsakalidou and K. Papadimitriou, eds., New York: Springer, 2011.
31. Campbell, D. R., et al. Mycobacterial cells have dual nickel-cobalt sensors: sequence relationships and metal sites of metal-responsive repressors are not congruent, *J. Biol. Chem.* **282**, 32298--32310, 2007.
32. Behera, M. et al. Effect of heavy metals on growth response and antioxidant defense protection in *Bacillus cereus*, *Basic Microbiol.* **54**, 1201--1209, 2014.
33. Howlet, N. G. & Avery, S. V. Induction of lipid peroxidation during heavy metal stress in *Saccharomyces cerevisiae* and influence of plasma membrane fatty acid unsaturation, *Appl. Environ. Microbiol.* **63**, 2971--6, 1997.
34. vanGinkel, G. & Sevanian, A. Lipid peroxidation-induced membrane structural alterations, *Methods Enzymol.* **88**, 233--273. 1994.

35. Lenartova, V., et al. The influence of mercury on the antioxidant enzyme activity of rumen bacteria *Streptococcus bovis* and *Selenomonas ruminantium*, *FEMS Microbiol. Ecol.* **27**, 319--25, 1998.
36. Harinasut, P., et al. Salinity effects on antioxidant enzymes in mulberry cultivator, *Sci. Asia* **29**, 109--113, 2003.
37. Gad El-Rab. S. M. F., et al. The influence of heavy metals toxicity on the antioxidant enzyme activities of resistance *E. coli* strains isolated from waste water sites, *Int. J. Curr. Microbiol. App. Sci.* **2**, 162--175, 2013.
38. Banjerdkij, P., et al. Exposure to cadmium elevates expression of genes in the *oxyr* and *ohrrregulons* induces cross - resistance to peroxide killing treatment in *Xanthomonas campestris*, *App. Environ. Microbiol.* **71**, 1843--1849, 2005.
39. Pandey, S., et al, Role of Heavy Metal resistant *Ochrobactrum* sp. and *Bacillus* sp. strains in bioremediation of a rice cultivar and their PGPR like activities, *J. Microbiol.* **51**, 11--17, 2013.
40. Choudhary, M., et al. Effect of heavy metal stress on Proline, Malondialdehyde and Superoxide Dismutase activity in the Cyanobacterium *Spirulina platensis*-S5, *Ecotoxicol. Environ. Safety*, **66**, 204--209, 2007.
41. Riccillo, P.M., et al. Glutathione is involved in environmental stress in *Rhizobium tropici*, including acid tolerance, *J. Bacteriol*, **182**, 1748--1753, 2000.
42. Goyer, R. A. Toxic effects of metals, in Casarett and Doull's *Toxicology: The Basic Science of Poisons*, 4th ed., M. O. Amdur, et al., eds., Pergamon Press, New York, 1991, 629--681.
43. Fox, B. & Walsh, C. T. Mercuric reductase, *J. Biol.Chem.* **257**, 2498--2503, 1982.
44. Blaghen, M., et al. Essential arginines in mercuric reductase isolated from *Yersinia enterocolitica* 138A 14, *Biochimie* **74**, 557--560, 1992.

45. Vijayaraghavan, K. & Yun, Y. S. Bacterial biosorbents and biosorption, *Biotechnol. Adv.* **26**, 266--291, 2008.
46. Mohan, D. & Pittman, C. U. Activated carbons and low cost adsorbents for remediation of tri and hexavalent chromium from water, *J. Hazard. Mater.* **137**, 762--811, 2006.
47. Murali, O., et al. Bioremediation of heavy metal using *Spirulina*, *Int. J. Geol.* **4**, 244--249, 2014.
48. Green-Ruiz, C., et al. Cadmium and zinc removal from aqueous solutions by *Bacillus jeotgali*: pH, salinity and temperature effects, *Biores. Technol.* **99**, 3864--3870, 2008.
49. Viera, R. H. S. F. & Volesky, B. Biosorption: a solution to pollution?, *Int. Microbiol.* **3**, 17--24, 2000.
50. Gupta, V. K. & Rastogi, A. Biosorption of lead from aqueous solutions by green algae *Spirogyra* species: kinetics and equilibrium studies, *J. Hazard. Mater.* **152**, 407--414, 2008.
51. Murali, O. & Mehara, S. Bioremediation of heavy metals using *Spirulina*, *Int. J. Geol.* **4**, 244--249, 2014.
52. Marc, J., et al. Bioremediation and tolerance of humans to heavy metals through microbial processes: a potential role for probiotics?, *Appl. Environ. Microbiol.* **78**, 6397--6404, 2012.
53. Fein, J. B., et al. Metal adsorption onto bacterial surfaces: development of a predictive approach, *Geochim. Cosmochim. Acta.* **65**, 4267--4273, 2001.
54. Halttunen, T., et al. Rapid removal of lead and cadmium from water by specific lactic acid bacteria, *Int. J. Food Microbiol.* **114**, 30--35, 2007.
55. Ibrahim, F., et al. Probiotic bacteria as potential detoxification tools: assessing their heavy metal isotherms, *Can. J. Microbiol.* **52**, 877--885, 2006.
56. Kulczycki E., et al. Sorption of cadmium and lead by bacteria-ferrihydrite composites, *Geomicrobiol. J.* **22**, 299--310, 2005.

57. Choudhary, S. & Sar, P. Characterization of a metal resistant *Pseudomonas* sp. isolated from uranium mine for its potential in heavy metal (Ni^{2+} , Co^{2+} , Cu^{2+} , and Cd^{2+}) sequestration, *Bioresour. Technol.* **100**, 2482--2492, 2009.
58. Naik, U. C., et al. Isolation and characterization of *Bacillus cereus* IST105 from electroplating effluent for detoxification of hexavalent chromium, *Environ. Sci. Pollut. Res. Int.* **19**, 3005--3014, 2011.
59. Yilmaz, E. I. Metal tolerance and biosorption capacity of *Bacillus circulans* strain EB1, *Res. Microbiol.* **154**, 409--415, 2003.
60. Nithya, C. Assessment and characterization of heavy metal resistance in Palk Bay sediment bacteria, *Mar. Environ. Res.* **71**, 283--294, 2011.
61. Jarup, L. Hazards of heavy metal contamination, *British Med. Bull.* **68**, 167--182, 2003.
62. Hazen, T. C. & Tabak, H. H. Developments in bioremediation of soils and sediments polluted with metals and radionuclides: 2. Field research on bioremediation of metals and radionuclides, *Reviews Environ. Sci. Bio/Technol.* **4**, 157--183, 2005.
63. Lloyd, J. R. & Lovley, D. R. Microbial detoxification of metals and radionuclides, *Curr. Opin. Biotechnol.* **12**, 248--253, 2001.
64. Nies, D. H. Microbial heavy-metal resistance, *Appl. Microbiol. Biotechnol.* **51**, 730--750, 1999.
65. Silva, N., et al. Cadmium a metalloestrogen: are we convinced?, *J. Appl. Toxicol.* **32**, 318--332, 2012.
66. Hawkes, S. J. What is a "Heavy Metal"?, *J. Chem. Edu.* **74**, 1374, 1997.
67. Weast, R. C. *CRC handbook of chemistry and physics*, 64 edn., CRC, Boca Raton, Fla., 1987.
68. Florea, A. M. & Busselberg, D. Occurrence, use and potential toxic effects of metals and metal compounds, *Bio Metals* **19**, 419--427, 2006.

69. Bargagli, R. Trace metals in Antarctica related to climate change and increasing human impact, *Rev. Environ. Contam. Toxicol.* **166**, 129--173, 2000.
70. Valls, M. & de Lorenzo, V. Exploiting the genetic and biochemical capacities of bacteria for the remediation of heavy metal pollution, *FEMS Microbiol. Rev.* **26**, 327--338, 2002.
71. WHO. *Inorganic Mercury*. Environmental Health Criteria, Geneva: World Health Organization, **118**, 1991
72. Bruins, M. R., et al. Microbial Resistance to Metals in the Environment, *Ecotoxicol. Environ. Safety* **45**, 198--207, 2000.
73. Hughes, M. N. & Poole, R. K. *Metals and Micro-organisms*, Chapman and Hall, London, 1989, 280--285.
74. Ji, G. & Silver, S. Bacterial resistance mechanism for heavy metals of environmental concern, *J. Ind. Microbiol.* **14**, 61--75, 1995.
75. Ehrenreich, A. & Widdel, F. Anaerobic oxidation of ferrous iron by purple bacteria, a new type of phototrophic metabolism, *Appl. Environ. Microbiol.* **60**, 4517--4526, 1994.
76. Nies, D. H. Resistance to cadmium, cobalt, zinc and nickel in microbes, *Plasmid* **27**, 17--28, 1992.
77. Appenroth, K. J. Definition of 'Heavy Metals' and Their Role in Biological Systems, in *Soil Heavy Metals, Soil Biology*, I. Sharameti and A. Varma, eds., Springer-Verlag Berlin Heidelberg, **19**, 2010.
78. Rengel, Z. Heavy metals as essential nutrients, in *Heavy metal stress in plants*, 3rd edn., M. N. V. Prasad, ed., Springer, Berlin, 2004, 271--294.
79. Kovacs, E., et al. Investigation into the mechanism of stimulation by low-concentration stressors in barley seedlings, *J. Plant. Physiol.* **166**, 72--79, 2009.
80. Nyitrai, P., et al. Involvement of the phosphoinositide signalling pathway in the anti-senescence effect of low-concentration stressors on detached barley leaves, *Plant Biol.* **9**, 420--426, 2007.

81. Abramowicz, D. A. & Dismukes, G. C. Manganese proteins isolated from spinach thylakoid membranes and their role in O₂ evolution. II. A binuclear manganese-containing 34 kilodalton protein, a probable component of the water dehydrogenase enzyme, *Biochim. Biophys. Acta.* **765**, 318--328, 1984.
82. Brudvig, G. W. The tetranuclear manganese complex of photosystem II, *J. Bioenerg. Biomembr.* **19**, 91--104, 1987.
83. Yachandra, V. K, et al. Where plants make oxygen: a structural model for the photosynthetic oxygen-evolving manganese cluster, *Science* **260**, 675--679, 1993.
84. Ahrling, K. A., Peterson, S. & Styring, S. An oscillating manganese electron paramagnetic resonance signal from the S₀ state of the oxygen evolving complex in photosystem II, *Biochemistry* **36**, 13148--13152, 1997.
85. Gilchrist, M. L. Jr, et al. Proximity of the manganese cluster of photosystem II to the redox-active tyrosine YZ, *Proc. Natl. Acad. Sci. USA* **92**, 9545--9549, 1995.
86. Hoganson, C. W. & Babcock, G. T. A metalloradical mechanism for the generation of oxygen from water in photosynthesis, *Science* **277**, 1953--1956, 1997.
87. Davis, C. M. & Vincent J, B. Isolation and characterization of a biologically active chromium oligopeptide from bovine liver, *Arch. Biochem. Biophys.* **339**, 335--343, 1997.
88. Costa, M. Toxicity and carcinogenicity of Cr (VI) in animal models and humans, *Crit. Rev. Toxicol.* **27**, 431--442, 1997.
89. Chou, A.Y., et al. Agrobacterium transcriptional regulator Ros is a prokaryotic zinc finger protein that regulates the plant oncogene *ipt*, *Proc. Natl. Acad. Sci. USA* **95**, 5293--5298, 1998.
90. Fitsanakis, V. A. & Aschner, M. The importance of glutamate, glycine, and gamma aminobutyric acid transport and regulation in manganese,

- mercury and lead neurotoxicity, *Toxicol. Appl. Pharmacol.* **204**, 343--354, 2005.
91. Singh, R., et al. Heavy metals and living systems: An overview, *Ind. J. Pharmacol.* **43**, 246--253, 2011.
92. Seidal K, et al. Fatal cadmium-induced pneumonitis, *Scand. J. Work Environ. Health* **19**, 429--31, 1993.
93. Barbee, J. Y. Jr. & Prince, T. S. Acute respiratory distress syndrome in a welder exposed to metal fumes, *South. Med. J.* **92**, 510--2, 1999.
94. Jarup, L., et al. Health effects of cadmium exposure-a review of the literature and a risk estimate, *Scand. J. Work Environ. Health* **24**, 1--51, 1998.
95. Weiss, B., Clarkson, T. W. & Simon, W. Silent latency periods in methylmercury poisoning and in neurodegenerative disease, *Environ. Health Perspect.* **110**, 851--4, 2002.
96. WHO. *Lead*. Environmental Health Criteria, Geneva: World Health Organization, **165**, 1995.
97. Lidsky, T. I. & Schneider, J. S. Lead neurotoxicity in children: basic mechanisms and clinical correlates, *Brain* **126**, 5--19, 2003.
98. Steenland, K. & Boffetta, P. Lead and cancer in humans: where are we now?, *Am. J. Ind. Med.* **38**, 295--9, 2000.
99. Kiilunen, M., et al. Exceptional pharmacokinetics of trivalent chromium during occupational exposure to chromium lignosulfonate dust, *Scand. Work Environ. Health*, **9**, 265--271, 1983.
100. Sunderman, F. W. Potential toxicity from nickel contamination of intravenous fluids, *Ann. Clin. Lab. Sci.* **13**, 1--4, 1983.
101. Pinto, E. Heavy metal-induced oxidative stress in algae, *J. Phycol.* **39**, 1008--1018, 2003
102. Van Ho, A., et al. Transition metal transport in yeast, *Annu. Rev. Microbiol.* **56**, 237--61, 2002.

103. Zalups, R. K. & Ahmad, S. Molecular handling of cadmium in transporting epithelia, *Toxicol. Appl. Pharmacol.* **186**, 163--88, 2003
104. Cumming, J. R. & Gregory, J. T. Mechanisms of metal tolerance in plants: physiological adaptations for exclusion of metal ions from the cytoplasm, in *Stress Responses in Plants: Adaptation and Acclimation mechanisms*, R. G. Alscher, et al., eds., Wiley-Liss, New York, 1990, 338--55.
105. Conner, S. D. & Schimid, S. L. Regulated portals of entry into the cell, *Nature* **422**, 37--44, 2003.
106. Rosen, B. Bacterial resistance to heavy metals and metalloids, *J. Biol. Inorg. Chem.* **1**, 273--7, 1996.
107. Kao, P. H., et al. Response of microbial activities to heavy metals in a neutral loamy soil treated with biosolid, *Chemosphere* **64**, 63--70, 2006
108. Umrana V. V. Bioremediation of toxic heavy metals using acidothermophilic autotrophies, *Bioresour. Technol.* **97**, 1237--1242, 2006.
109. Joner, E. J., et al. Metal-binding capacity of arbuscular mycorrhizal mycelium, *Plant and Soil* **226**, 227--234, 2000
110. Silver, S. Bacterial resistance to toxic metal ions-a review, *Gene* **179**, 9-19, 1996.
111. Leedjarv, A., et al. Interplay of different transporters in the mediation of divalent Heavy metal resistance in *P. putida* KT2440, *J. Bacteriol.* **190**, 2680--2689, 2008.
112. Fleischmann, R. D, et al. Whole genome random sequencing and assembly of *Haemophilus influenza* Rd, *Science* **269**, 496--512, 1995.
113. Kanamaru, K., et al. A copper-transporting P-type ATPase found in the thylakoid membrane of the cyanobacterium *Synechococcus* species PCC7942, *Mol. Microbiol.* **13**, 369--77, 1994.
114. Rehman, A. & Anjum, M. S. Multiple metal tolerance and biosorption of cadmium by *Candida tropicalis* isolated from industrial effluents:

- glutathione as detoxifying agent, *Environ. Monit. Assess.*, **174**, 585--595, 2011.
115. Corticeiro, S. C., et al. The importance of glutathione in oxidative status of *Rhizobium* biovar *viciae* under Cd exposure, *Enzyme Microbial. Technol.* **40**, 132--137, 2006.
116. Bianucci, E., et al. Involvement of glutathione and enzymatic defense system against cadmium toxicity in *Bradyrhizobium* sp. strains (peanut symbiosis), *Biometals* **25**, 23--32, 2012.
117. Kilic, N. K., et al. Proteomic changes in response to chromium (VI) toxicity in *Pseudomonas aeruginosa*, *Bioresour. Technol.* **101**, 2134--2140, 2010.
118. Daware, V., et al. Effects of arsenite stress on growth and proteome of *Klebsiella pneumoniae*, *J. Biotechnol.* **158**, 8--16, 2012
119. Sharma, S., et al. Role of proteins in resistance mechanism of *Pseudomonas fluorescens* against heavy metal induced stress with proteomics approach, *J. Biotechnol.* **126**, 374--382, 2006.
120. Thompson, D. K., et al. Proteomics reveals a core molecular response of *Pseudomonas putida* F1 to acute chromate challenge, *BMC Genomics* **11**, 1--16, 2010.
121. Carapito, C., et al. Identification of genes and proteins involved in the pleiotropic response to arsenite stress in *Caenibacter arsenoxydans*, a metalloresistant beta-proteobacterium with an unsequenced genome, *Biochimie*, **88**, 595--606, 2006.
122. Perales-Vela, H. V., et al. Heavy metal detoxification in eukaryotic microalgae, *Chemosphere* **64**, 1--10, 2006.
123. Stokes, P.M., et al. A low molecular weight copper-binding protein in a copper tolerant strain *Scenedesmus acutiformis*, in *Trace Substances in Environmental Health*, D.D. Hemphil, ed., University of Missouri Press, Columbia, 1977, 146--154.

124. Knauer, K., et al. Metal and phytochelatin content in phytoplankton from freshwater lakes with different metal concentrations, *Environ. Toxicol. Chem.* **17**, 2444--2452, 1998.
125. Howe, G., Merchant, S., Heavy metal-activated synthesis of peptides in *Chlamydomonas reinhardtii*, *Plant Physiol.* **98**, 127--136, 1992.
126. Torricelli, E., et al. Cadmium tolerance, cysteine and thiol peptide levels in wild type and chromium-tolerant strains of *Scenedesmus acutus* (Chlorophyceae), *Aquat. Toxicol.* **68**, 315--323, 2004.
127. Tsuji, N., et al. Enhancement of tolerance to heavy metals and oxidative stress in *Dunaliella tertiolecta* by Zn-induced phytochelatin synthesis, *Biochem. Biophys. Res. Co.* **293**, 653--659, 2002.
128. Reed, R. H. & Gada, G. M. Metal tolerance in eukaryotic and prokaryotic algae, in *Heavy Metal Tolerance in Plants: Evolutionary Aspects*, A. J. Shaw, ed., CRC Press, Boca Raton, FL, 1990, 105--118.
129. Jordanova, A., et al. Heavy metal assessment in algae, sediments and water from the Bulgarian Black Sea Coast, *Water Sci. Tech.* **39**, 207--12, 1999.
130. Collen, J. & Davison, I. R. Stress tolerance and reactive oxygen metabolism in the intertidal red seaweeds *Mastocarpus stellatus* and *Chondrus crispus*, *Plant Cell Environ.* **22**, 1143--1151, 1999.
131. Hu, S., et al. Cadmium accumulation by several seaweeds, *Sci. Total Environ.* **187**, 65--71, 1996.
132. Okamoto, O. K., et al. Acute and chronic effects of toxic metals on viability, encystment and bioluminescence in the dinoflagellate *Gonyaulax polyedra*, *Comp. Biochem. Physiol. C. Pharmacol. Toxicol. Endocrinol.* **123**, 75--83, 1999.
133. Lage, O. M., et al. Some effects of copper on the dinoflagellates *Amphidinium carterae* and *Prorocentrum micans* in batch culture, *Eur. J. Phycol.* **29**, 253--60, 1994.

134. Machuca, A., et al. Metal-chelating compounds produced by ectomycorrhizal fungi collected from pine plantations, *Lett. Appl. Microbiol.* **44**, 7--12, 2007.
135. Fomina, M., et al. Role of oxalic acid over excretion in transformations of toxic metal minerals by *Beauveria caledonica*, *Appl. Environ. Microbiol.* **71**, 371--381, 2005.
136. Abhishek, M., Tolerance of arsenate induced stress in *Aspergillus niger*, a possible candidate for bioremediation, *Ecotoxicol Environ. Safety* **73**, 172--182, 2010.
137. Ulla, A.J., et al. Organic acids produced by mycorrhizal *Pinus sylvestris* exposed to elevated aluminium and heavy metal concentrations, *New Phytologist*, **146**, 557--567, 2000.
138. Tanja, D. & Andrea, P. Transport and detoxification of manganese and copper in plants, *Braz. J. Plant Physiol.* **17**, 103--112, 2005.
139. Bano, S. A., & Ashfaq, D. Role of mycorrhiza to reduce heavy metal stress, *Natural Sci.* **5**, 16--20, 2013.
140. Boussama, N., et al. Changes in growth and nitrogen assimilation in barley seedlings under cadmium stress, *J. Plant Nutr.* **22**, 731--752, 1999.
141. Patra, M. & Sharma, A. Mercury toxicity in plants, *Bot. Rev.* **66**, 379--422.
142. Choo, K. S. et al. Oxidative stress tolerance in the filamentous green algae *Cladophora glomerata* and *Enteromorpha ahlnneriana*, *J. Exp. Mar. Biol. Ecol.* **298**, 111--123, 2003.
143. Huang, G. Y., et al. The effect of multiple heavy metals on ascorbate, glutathione and related enzymes in two mangrove plant seedlings (*Kandelia candel* and *Bruguiera gymnorhiza*), *Int. J. Oceanography Hydrobiol.* **1**, 11--25, 2010.
144. Aravind, P. & Prasad, M. N. V. Modulation of cadmium-induced oxidative stress in *Ceratophyllum demersum* by zinc involves ascorbate-

- glutathione cycle and glutathione metabolism, *Plant Physiol. Biochem.* **43**, 107--116, 2005.
145. Noctor, G. & Foyer, C. H. Ascorbate and glutathione: keeping active oxygen under control, *Annu. Rev. Plant Physiol. Plant Mol. Biol.* **49**, 249--279
146. Potters, G., et al. Ascorbate and glutathione: guardian of the cell cycle, partners in crime?, *Plant Physiol. Biochem.* **40**, 537--548, 2002
147. Grill, E. et al. Phytochelatins, the heavy metal binding peptides of plants are synthesized from glutathione by a specific glutamyl cysteine dipeptidyl transpeptidase (phytochelatin synthase), *Proc. Natl. Acad. Sci. USA* **86**, 6838--6842, 1989.
148. Rauser, W. E. Phytochelatin and related peptides. Structure, biosynthesis and function, *Plant Physiol.* **109**, 1141--1149, 1995.
149. Cobbett, C. S. Phytochelatin biosynthesis and function in heavy metal detoxification, *Curr. Opin. Plant Biol.* **3**, 211--216, 2000.
150. Yadav, S. K. Heavy metals toxicity in plants: An overview on the role of glutathione and phytochelatin in heavy metal stress tolerance of plants. *S. Afr. J. Bot.* **76**, 167--179. 2010.
151. Tseng, T. S., et al. The heatshock response in rice seedlings isolation and expression of cDNAs that encode class-I low-molecular weight heat-shock proteins, *Plant Cell Physiol.* **34**, 195--206, 1993.
152. Williams, L. E., et al. Emerging mechanisms of heavy metal transport in plants, *Biochimica et Biophysica Acta* **1465**, 104--126, 2000.
153. Ernsst, W. H. O., et al. Metal tolerance in plants, *Acta Bot. Neerl.* **41**, 229--248, 1992.
154. Liebeke, M., et al. Earthworms Produce phytochelatin in Response to Arsenic, *PLoS ONE* **8**, e81271, 2013
155. Rigouin, C., et al. Towards an Understanding of the Function of the Phytochelatin Synthase of *Schistosoma mansoni*, *PLoS Negl. Trop. Dis.* **7**, e2037, 2013.

156. Hu, H. Exposure to metals, *Primary Care Clin. Office Practice* **27**, 983-996, 2000.
157. Costa, M. two-component signal transduction system involved in nickel sensing in the cyanobacterium *Synechocystis* sp. PCC 6803, *Sci. Prog.* **81**, 329--339A, 1998.
158. <http://www.speciation.net/News/The-Role-of-Phytochelatin-for-Metal-Detoxification-in-Animals-~/2014/01/31/7080>.
159. Miller, J. R. *Escherichia coli* LipA is a lipoyl synthase: In vitro biosynthesis of lipoylated pyruvate dehydrogenase complex from octanoyl-acyl carrier protein, *Biochemistry* **39**, 15166--15178, 2000.
160. Spalding, M. D. & Prigge, S. T. Lipoic acid metabolism in microbial pathogens, *Microbiol. Mol. Biol. Rev.* **74**, 200--228, 2010.
161. Christensen, Q. H. & Cronan, J. E. Lipoic acid synthesis: A new family of octanoyl transferases generally annotated as lipoate protein ligases, *Biochemistry*, **49**, 10024--10036, 2010.
162. Packer, L., et al. Alpha-lipoic acid as biological antioxidant, *Free Rad. Biol. Med.* **19**, 227--250, 1995.
163. Izzo, F. N., et al. Lipoic acid: a unique antioxidant in the detoxification of activated oxygen species, *Plant Physiol. Biochem.* **40**, 463--470, 2002.
164. Ghibu, S., et al. Antioxidant properties of an endogenous thiol: Alpha-lipoic acid, useful in the prevention of cardiovascular diseases. *J. Cardiovasc. Pharmacol.* **54**, 391--398, 2009.
165. Vig-Varga E, et al. Alpha-lipoic acid modulates ovarian surface epithelial cell growth, *Gynecol. Oncol.* **103**, 45--52, 2006.
166. Muller L. Protective effects of DL- α -lipoic acid on cadmium-induced deterioration of rat hepatocytes, **58**, 175-85, 1989.
167. Sumathi, R., et al. Effect of DL α -lipoic acid on tissue redox state in acute cadmium challenged tissues, *J. Nut. Biochem.* **7**, 85--92, 1996.

168. Halim, M., et al. Potential availability of heavy metals to phytoextraction from contaminated soils induced by exogenous humic substances, *Chemosphere* **52**, 26--75, 2002.
169. Long, X. X., et al. Current status and prospective on phytoremediation of heavy metal polluted soils, *J. Appl. Ecol.* **13**, 757--62, 2002.
170. Clemens, S. Toxic metal accumulation, responses to exposure and mechanisms of tolerance in plants, *Biochimie* **88**, 1707--1719, 2006.
171. Barcelo, J. & Poschenrieder, C. Structural and ultrastructural changes in heavy metal exposed plants in *Heavy metal stress in plants*, M. N. V. Prasad, 3rd edn., Springer, Berlin, 2004, 223--248.
172. Appenroth, K. J. Definition of 'Heavy Metals' and Their Role in Biological Systems, in *Soil Heavy Metals, Soil Biology*, I. Sherameti and A. Varma eds., **19**, Springer-Verlag Berlin Heidelberg, 2010.
173. Joo, J. H., et al. Comparative study of biosorption of Zn^{2+} by *Pseudomonas aeruginosa* and *Bacillus cereus*, *Int. Biodeter. Biodegr.* **64**, 734--741, 2010.
174. Kratochvil, D. & Volesky, B. Advances in the biosorption of heavy metals, *Trends Biotechnol.* **16**, 291--300, 1998.
175. Norton, L., et al. Biosorption of zinc from aqueous solutions using biosolids, *Adv. Env. Res.* **8**, 629--635, 2004.
176. Vinopal, S., et al. Biosorption of Cd^{2+} and Zn^{2+} by cell surface engineered *Saccharomyces cerevisiae*, *Int. Biodeter. Biodegrad.* **60**, 96-102, 2007.
177. Volesky, B. & Schiewer, S. Biosorption, metals, in *Encyclopedia of Bioprocess Technology: Processes Fermentation Biocatalysis and Biosorption*, M. C. Flickinger et al., eds., John Wiley and sons, New York, 2000, 433--453.
178. Gabr, R. M., et al. Biosorption of lead and nickel by living and non living cells of *P. aeruginosa* ASU 6a, *Int. Biodeter. Biodegr.* **62**, 195--203, 2006.

179. De Rore, H., et al. Evolution of heavy metal-resistant transconjugants in a soil environment with a concomitant selective pressure, *FEMS Microbiol. Ecol.* **14**, 263--273, 1994.
180. Janssen, D. B., et al. Genetics and biochemistry of 1, 2-dichloroethane degradation, *Biodegradation* **5**, 249--257, 1994.
181. Murgerfeld, I., et al. A putative azoreductase gene is involved in the *Shewanella oneidensis* response to heavy metal stress, *Appl. Microbiol. Biotechnol.* **82**, 1131--1141, 2009.
182. Diels, L., et al. From industrial sites to environmental applications with *Cupriavidus metallidurans*, *Antonie van Leeuwenhoek* **96**, 247--258, 2009.
183. Chekroun, K. B. & Baghour, M. The role of algae in phytoremediation of heavy metals: A review, *J. Mater. Environ. Sci.* **4**, 873--880, 2013.
184. Dwivedi, S. Bioremediation of Heavy Metals by Algae: Current and Future Perspective, *J. Adv. Lab. Res. Biol.* **3**, 195--199, 2012.
185. Priyadarshani, I. et al. Microalgal bioremediation: Current practices and perspectives, *J. Biochem. Tech.* **3**, 299--304, 2011.
186. Kapoor, A. & Viraraghavan, T. Fungal biosorption - an alternative treatment option for heavy metal bearing wastewaters: a review, *Bioresour. Technol.* **53**, 195--206, 1995
187. Bishnoi, N. R. & Garima. Fungus - An alternative for bioremediation of heavy metal containing wastewater. A review, *J. Sci. Indust. Res.* **64**, 93--100, 2005.
188. Tobin, J. M., et al. Uptake of metal ion by *Rhizopus arrhizus* biomass, *Appl. Environ. Microbiol.* **47**, 821-- 824, 1984.
189. Volesky, B. & Holan, Z. R. Biosorption of heavy metals, *Biotechnol. Prog.* **11**, 235--250, 1995.
190. Kapoor, A., et al. Removal of heavy metals using the fungus *Aspergillus niger*, *Bioresour. Technol.* **70**, 95--104, 1999.

191. Gadd, G. M., Fungi and yeasts for metal accumulation in *Microbial Mineral Recovery*, H. L. Ehrlich & C. L. Brierley, eds., McGraw-Hill, New York, 1990, 249--276,
192. Leyval, C. K., et al. Effect of heavy metal pollution on mycorrhizal colonization and function: physiological, ecological and applied aspects, *Mycorrhiza* **7**, 3139--3153, 1997.
193. Joner, E. J., et al. Metal-binding capacity of arbuscular mycorrhizal mycelium, *Plant and Soil* **226**, 227--234, 2000.
194. Khan, A. G. Role of soil microbes in the rhizospheres of plants growing on trace element contaminated soils in phytoremediation, *J. Trace Elem. Med. Biol.* **18**, 355--364, 2005.
195. Silva, N., et al. Cadmium a metalloestrogen: are we convinced?, *J. Appl. Toxicol.* **32**, 318--332, 2012.
196. Aprill, W. & Sims, R. C. Evaluation of the use of prairie grasses for stimulating polycyclic aromatic hydrocarbon treatment in soil, *Chemosphere* **20**, 253--265, 1990.
197. Kuiper, I., et al. Selection of a plant-bacterium pair as a novel tool for rhizostimulation of polycyclic aromatic hydrocarbon-degrading bacteria, *Mol. Plant-Microbe Interact.* **14**, 1197--1205, 2001.
198. Nichols, T. D., et al. Rhizosphere microbial populations in contaminated soils, *Water Air Soil Pollut.* **95**, 165--178, 1997.
199. Campbell, R. & Greaves, M. P. Anatomy and community structure of the rhizosphere, in *The Rhizosphere*, J. M. Lynch, ed., Wiley & Sons, Chichester, UK, 1990, 11--34.
200. Kuiper, I., et al. Rhizoremediation: a beneficial plant-microbe interaction, *Mol. Plant Microbe Interact.* **17**, 6--15, 2004.
201. Garrity, M. G., et al. Taxonomic Outline of the Prokaryotes Bergy's Manual of Systematic Bacteriology, 2nd ed., Springer, New York, 2004.
202. Klingler, J. M., et al. Evaluation of the biolog automated microbial identification system, *Appl. Environ. Microbiol.* **58**, 2089--2092, 1992.

203. Sanger, F., Nicklen, S. & Coulson, A. R. DNA sequencing with chain-terminating inhibitors, *Proc. Natl. Acad. Sci.* **74**, 5463--5467, 1977.
204. Mistry, K., et al. Hexavalent chromium reduction by *Staphylococcus* sp. isolated from Cr (VI) contaminated land fill, *Int. J. Biotechnol. Biochem.* **6**, 117--129, 2010.
205. Thacker, U. & Madamwar, D. Reduction of toxic chromium and partial localization of chromium reductase activity in bacterial isolate DM1, *World J. Microbiol. Biotechnol.* **21**, 891--899, 2005.
206. Moron, M. A., Depierre, J. W. & Mannervick, B. Levels of glutathione, glutathione reductase and glutathione S-transferase activities in rat lung and liver, *Biochim. Biophys. Acta.* **582**, 67--78, 1979.
207. Varshney, R. & Kale, R. K. Effects of calmodulin antagonists on radiation induced lipid peroxidation in microsomes, *Int. J. Rad. Biol.* **58**, 733--743, 1990.
208. Marklund, S. & Marklund, G. Involvement of the superoxide anion radical in the autoxidation of pyragallol and a convenient assay for superoxide dismutase, *Eur. J. Biochem.* **47**, 469--474, 1974.
209. Aebi, H. Catalase in vitro, *Methods Enzymol.* **105**, 121--126, 1984.
210. Buckova, M. et al., Screening of bacterial isolates from polluted soils exhibiting catalase and peroxidase activity and diversity of their response to oxidative stress, *Curr. Biotechnol.* **61**, 241--247, 2010.
211. Paglia, D. E. & Valentine W. M. Studies on the quantitative and qualitative characterization of erythrocyte glutathione peroxidase, *J. Lab Clin. Med.* **70**, 158--169, 1967.
212. Carberg, I. & Mannervik, B. Glutathione reductase, in *Methods in Enzymology*, vol. **113**, Academic Press, New York, 484--490, 1985
213. Lowry, O. H., et al. Protein measurement with the Folin phenol reagent, *J. Biol. Chem.* **193**, 265--275, 1951.

214. Neumann, G., et al. Cells of *Pseudomonas putida* and *Enterobacter* sp. adapt to toxic organic compounds by increasing their size, *Extremophiles* 163--168, 2005.
215. D'Souza, L. et al. Use of fourier transform infrared (FTIR) spectroscopy to study cadmium-induced changes in *Padina tetrastratica* (Hauck), *Anal. Chem. Insights* **3**, 135--143, 2008.
216. Sar, P., et al. Intracellular nickel accumulation by *Pseudomonas aeruginosa* and its chemical nature, *Lett. Appl. Microbiol.* **32**, 257--261, 2001.
217. Ausubel, F. M., et al. *Short protocols in molecular biology*, Wiley, New York, 1995.
218. Zhang, Y. I-TASSER server for protein prediction, *BMC Bioinformatics* **9**, 40--50, 2008.
219. Roy, A., et al. COFACTOR: An accurate comparative algorithm for structure-based protein function annotation, *Nucleic Acids Res.*, **40**, W471--W477, 2012.
220. Xu, D. & Zhang, Y. Improving the physical realism and structural accuracy of protein models by a two-step atomic level energy minimization, *Biophys J.* **101**, 2525--34, 2011.
221. Lovell, S. C., et al., Structure validation by C α geometry: ϕ , ψ and C β deviation, *Proteins* **50**, 437--450, 2003.
222. Zhou, H. & Zhou, Y. Distance-scaled, finite ideal-gas reference state improves structure-derived potentials of mean force for structure selection and stability prediction, *Protein Sci.* **11**, 2714--26, 2002.
223. Hussein, A. & Joo, H. J. Heavy metal resistance of bacteria and its impact on the production of antioxidant enzymes, *Afr. J. Microbiol. Res.* **7**, 2288--2296, 2013.
224. Wunsche, L. & Babel, W. The suitability of the biolog automated microbial identification system for assessing the taxonomical composition of terrestrial bacterial communities, *Microbiol. Res.* **151**, 133--143, 1996.

225. Lothar, W. & Wolfgang, B. The suitability of the Biolog Automated Microbial Identification System for assessing the taxonomical composition of terrestrial bacterial communities, *Microbiol. Res.* **151**, 133--143, 1996.
226. Dhakephalkar, P. K. & Chopade, B. A. High levels of multiple metal resistances and its correlation to antibiotic resistance in environmental isolates of *Acinetobacter*, *Biometals* **7**, 67--74, 1994.
227. Hassen, A, et al. Resistance of environmental bacteria to heavy metals, *Bioresour. Technol.* **64**, 7--15, 1998.
228. Chelliah, E. R, et al. Isolation and characterization of a metal-resistant *Pseudomonas aeruginosa* strain, *World J. Microbiol. Biotechnol.* **22**, 577--585, 2006.
229. Abassi, N. A., et al. Active oxygen-scavenging enzymes activities in developing apple flowers and fruits, *Sci. Horti.* **74**, 183--194, 1998.
230. Behera, M, et al. Effect of heavy metals on growth response and antioxidant defense protection in *Bacillus cereus*, *J. Basic Microbiol.* **54**, 1201--1209, 2014.
231. Sobkowiak, R., et al. Cadmium induced changes in antioxidant enzymes in suspension culture of soybean cells, *Acta Biochem. Polonica.* **51**, 219--222, 2004.
232. Grant, C. M., et al. Glutathione is an essential metabolite required for resistance to oxidative stress in the yeast *Saccharomyces cerevisiae*, *Curr. Genet.* **29**, 511--515, 1996.
233. Perez, R. R., & Sousa, C. A, Evaluation of the role of glutathione in the lead-induced toxicity in *Saccharomyces cerevisiae*, *Curr. Microbiol.* **67**, 300--305, 2013.
234. Carmel, H, O. & Storz, G. Roles of the glutathione and thioredoxin dependent reduction systems in the *Escherichia coli* and *Saccharomyces cerevisiae* responses to oxidative stress, *Annu. Rev. Microbiol.* **54**, 439--461, 2000.

235. Halliwell, B. & Gutteridge, J. M. *Free Radicals in Biology and Medicine*, 3rd edn, Oxford University J. M. C Press, New York, 2001
236. Bianucci, E., et al. Cadmium accumulation and tolerance in *Bradyrhizobium* spp (peanut microsymbionts), *Curr. Microbiol.* **62**, 96--100, 2011.
237. Chakravarty, R., & Banerjee, P. Morphological changes in an acidophilic bacterium induced by heavy metals, *Extremophiles* **12**, 279--284, 2008.
238. Chakravarty, R., et al. Morphological changes in an *Acidocella* strain in response to heavy metal stress, *Res. J. Microbiol.* **2**, 742--748, 2007.
239. Naik, U. C, et al. Isolation and characterization of *Bacillus cereus* IST105 from electroplating effluent for detoxification of hexavalent chromium, *Environ. Sci. Pollut. Res.* **19**, 3005--3014, 2012.
240. Pagnanelli, F., et al. Biosorption of metal ions on *Arthrobacter* sp.: biomass characterization and biosorption modeling, *Environ. Sci. Technol.* **34**, 2773--2778, 2000.
241. Fourest, E., et al. Improvement of heavy metal biosorption by mycelial dead biomasses (*Rhizopus arrhizus*, *Mucor miehei* and *Penicillium chrysogenum*): pH control and cationic activation, *FEMS Microbiol. Rev.* **14**, 325--32, 1994.
242. Stuart, B. H. *Biological applications of infrared spectroscopy*, 1st ed., D. J. Ando, ed., Wiley, New York, 1997.
243. Dumas, P. & Miller, L. The use of synchrotron infrared microspectroscopy in biological and biomedical investigations, *Vib. Spec.* **32**, 3--21, 2003.
244. Fischer, G., et al. FT-IR. Spectroscopy as a tool for rapid identification and intra-species characterization of airborne filamentous fungi, *J. Microbiol. Meth.* **64**, 63--77, 2006.
245. Byler, D. M. and Susi, H. Examination of the Secondary Structure of Proteins by deconvolved FTIR spectra, *Biopolymers* **25**, 469--87, 1986.

246. Wolkers, W. F., et al. A fourier transform infrared spectroscopy study of sugar glasses, *Carb. Res.* **339**, 1077--85, 2004.
247. Yee, N., et al. Characterization of metal-Cyanobacteria sorption reactions: A combined Macroscopic and infrared spectroscopic investigation, *Environ. Sci. Technol.* **38**, 775--82, 2004.
248. Fiona, H. F., et al. Macrocyclic copper (II) and Zinc (II) complexes incorporating phosphate esters, *Inorg. Chem.* **42**, 5637--44, 2003.
249. Wolpert, M. & Hellwig, P. Infrared spectra and molar absorption coefficients of the 20 alpha amino acids in aqueous solutions in the spectral range from 1800 to 500 cm^{-1} , *Spectrochim Acta. A Mol. Biomol. Spectrosc.* **64**, 987--1001, 2006.
250. Kazy, S. K., et al. Uranium and thorium sequestration by a *Pseudomonas* sp.: mechanism and chemical characterization, *J. Hazard. Mater.* **163**, 65--72, 2009.
251. Kazy, S. K., et al. Lanthanum biosorption by a *Pseudomonas* sp. equilibrium studies and chemical characterization, *J. Ind. Microbiol. Biotechnol.* **33**, 773--783, 2006.
252. Velasquez, L. & Dussan, J. Biosorption and bioaccumulation of heavy metals on dead and living biomass of *Bacillus sphaericus*, *J. Hazard. Mater.* **15**, 167--713, 2009.
253. Ramirez, M., et al. Mechanisms of bacteria resistance to chromium compound, *Biometals.* **21**, 321--332, 2008.
254. Monaschese, M., Burton, J. P., & Reid, G. Bioremediation and Tolerance of Humans to heavy metals through microbial Processes: a Potential role for Probiotics?, *Appl. Environ. Microbiol.* **78**, 6397--6407, 2012.
255. Tosukhowong, A., et al. Reconstruction and function of *Tetragenococcus halophila* chaperonin 60 tetradecamer, *J. Biosci. Bioeng.* **99**, 30--37, 2005.
256. Zhou, J. & Xu, Z., The structural view of bacterial translocation-specific chaperone SecB: implications for function, *Mol. Microbiol.* **58**, 349--35, 2005.

257. Ferreira, V.S., et al. Gene expression patterns in *Euglena gracilis*: insights into the cellular response to environmental stress, *Gene* **389**, 136--145, 2007.
258. Valls, M., et al. Engineering outer-membrane proteins in *Pseudomonas putida* for enhanced heavy-metal bioadsorption, *J. Inorg. Biochem.* **79**, 219--223, 2000.
259. Wang, L., et al. Comprehensive analysis of the variation of Cu^{+2} adsorption capacity of *Pseudomonas putida* 5-x cell envelope with cell age, *Enzyme Microbial. Technol.* **34**, 474--481, 2004.
260. Nies, A. et al. Nucleotide sequence and expression of a plasmid-encoded chromate resistance determinant from *Alcaligenes eutrophus*, *J. Biol. Chem.* **265**, 5648--5653, 1990.
261. Bonomi, F., et al. Assembly of $[\text{FeSn}(\text{SR})_4]^{2-}$ ($n = 2,4$) in aqueous media from iron salts, thiols, and sulfur, sulfide, or thiosulfate plus rhodanese, *Inorg. Chem.* **24**, 4331--4335, 1985.
262. Cornaro, U. et al. Evidences for the formation of complexes of DL-dihydrolipoic acid (reduced lipoic acid) with Ni^{2+} , Co^{2+} , and Fe^{3+} salts, *Rev. Port. Quim.* **27**, 273--274, 1985.
263. Lachman, J. et al. Potato tubers as a significant source of antioxidants in human nutrition, *Rostlinna vyroba.* **46**, 231--236, 2000.
264. Scott, B. C. et al. Lipoic and dihydrolipoic acid as antioxidants. A critical evaluation, *Free Rad. Res.* **20**, 119--133, 1994.
265. Parry, R.J. Biosynthesis of some sulfur-containing natural products. Investigations on the mechanism of carbon-sulfur bond formation, *Tetrahedron* **39**, 1215--1238, 1983.
266. Van den Boom, T. J., et al. Lipoic acid metabolism in *Escherichia coli*: isolation of null mutants defective in lipoic biosynthesis, molecular cloning and characterization of *E. coli* lip locus, and identification of the lipoylated protein of the glycine cleavage system, *J. Bacteriol.* **173**, 6411--6420, 1991.

267. Reed, K. E. & Cronan, J.E. Jr, Lipoic acid metabolism in *Escherichia coli*: sequencing and functional characterization of the *lipA* and *lipB* genes, *J. Bacteriol.* **175**, 1325--1336, 1993.
268. White, R.H. Stable isotope studies on the biosynthesis of lipoic acid in *Escherichia coli*, *Biochemistry* **19**, 15--19, 1980.
269. Hayden, M. A., et al. Biosynthesis of lipoic acid: characterization of the lipoic acid auxothrops *Escherichia coli* W1485-lip2 and JRG33-lip9, *Biochem.* **32**, 3778--3782, 1993.