Index

| Aberdeen (Scotland), 10, 187 Abortifacient equivalent, 15. See also | Bangkok, 106 Bangladesh, 21 |
|---|---|
| Abortion pills; Water lead, historical levels | Blood lead. See Water lead, and blood lead |
| derivation of, 57–59 (table 3.2n) in Massachusetts cities and towns, 16, 57–59 (table 3.2), 75, 110, 117 relationship to current EPA lead threshold, 60 | Boston, 136, 144, 153, 191 cases of water-related lead poisoning in, 71, 187 lead solvency of water in, 70–71, 124–125, 186–187 |
| Abortion pills, 15–16, 51, 52, 72, 75, 110, 117, 120–121. <i>See also</i> | undiagnosed lead poisoning in, 113–114 |
| Abortifacient equivalent lead contained in, 53, 56 popularity of, 53 | water-lead levels in, 54–55, 204 Boston doctrine. <i>See</i> Doctrine of protective power |
| Abortions. <i>See</i> Spontaneous abortions Acid rain. <i>See</i> Water lead, and acid | British Medical Journal, 53, 62, 64, 66, 72, 79, 82, 99, 108, 126–127, 159 |
| rain Adams, Horatio, 123–126, 128 ALAD (-aminolevulinic acid | Brown, John, 119–121, 147–149 Bryant, S. D., 205 |
| dehydratase), 35, 43, 46 | Calcium |
| Alderson, James, 103–104 Alkalinity. <i>See</i> Water lead, and | and bone-lead mobilization, 38, 82, 93 and lead absorption, 36 |
| alkalinity | lead's ability to supplant, 41 |
| Allen, Alfred H., 127, 162–63 American Journal of Public Health, 49 | and neurotransmission, 41, 42 physiological functions of, 41, 50 |
| American Medical Association, 157, 158, 167 | and protein kinase C (PKC), 42, 44 and water hardness, 59, 124, 206 (see |
| Amherst (Massachusetts), 159–160 Arsenic, 2, 21, 206 | also Water hardness) and water treatment, 137 (see also |
| Arsenic, 2, 21, 200 | Water treatment) |
| Bacup (England), 122, 147–149 | Campbell, Dame Janet, 90, 91 |
| epidemic of water-related lead poisoning in, 117–21 | Cape Town, 13, 14, 15 Chicago, 13, 14, 166–167, 194 |

Cholera, 6, 7, 69, 193, 197. See also Glasgow, cholera in fear caused by, 17, 112–113 and political change, 175-178 swiftness of, 17 symptoms of, 17, 112 Clarke, John S., 183–185, 188–189, Colwells, Shaw, & Willard Manufacturing Company, 152–154, Cranstonhill Water Company, 170, 171, 177, 178 Crawford, Robert, 181, 182, 184, 193 Croton water supply. See also New York City complexity of, system, 191, 192 and cost of aqueduct, 191, 192 lead solvency of, 5–8 and typhoid fever in New York City, 6 Cryptosporidium, 205–206

Date sources, 19, 212-213, 235-236, 240, 243, 248, 251 reliability of, 20, 257n11 Devonshire colic, 26 Diachylon. See Abortion pills Doctrine of protective power, 18, 123. See also Water hardness, and lead solvency; Water lead, determinants of and alkalinity of water, 132–133 and CO₂ content of water, 125, 133-136 evidence regarding, 126–136 false sense of security promoted by, 128 - 129misapplication of, 17, 123, 138, 135–137, 150, 166–167 and origins of water treatment, 136– 138 (see also Water treatment) unreliability of, 17, 125-136, 251-253 versions of, 124-125 Doremus, R. Ogden, 2, 3, 153

and convulsions of unknown origin, 93, 97, 248–250 current understanding of, 38 and female employment, 82, 90-91 geographic variation in rates of, 19, 80, 83–93 historical theories of, 78–81, 85, 89, incidence of, 78, 87 and industrialization, 86, 90, 92 and infant health, 78, 84–85 long-term health effects from, 78 and mobilization of bone lead, 38-40, 82, 97 and nutrition, 79, 81, 89, 93 and oxidative stress, 47 (see also oxidative stress) and prenatal care, 90, 93 and prior lead exposure, 39, 82 and sepsis, 87–88, 91 symptoms of, 38, 77 with symptoms similar to acute lead poisoning, 82, 85, 267n29 and urbanization, 86, 90, 92, 93 and water-lead levels, 19, 83-93, 97, 243 - 247Edinburgh, 10, 124, 155, 187 Edinburgh doctrine. See Doctrine of protective power, versions of Ellet, William H., 153, 154, 155, 158 Engineering News, 151, 152 Engineers. See Thomas, R. J.; Lead water pipes, and engineers England, 16, 19, 22, 26, 66, 123, 137, 202, 204 abortion practices in, 51-53, 56 (see also Abortifacient equivalent; Abortion pills) cases of water-related lead poisoning in, 103–105, 129, 159 (see also Alderson, James; Brown, John; Porritt, Norman; Swann, Alfred; Thresh, John C.) eclampsia in, 78, 83, 84, 86-93 (see also Eclampsia)

Eclampsia, 20, 91, 146

epidemics of water-related lead poisoning in, 21, 117-121, 126-127 (see also Bacup (England); Huddersfield (England); Sheffield (England); Yorkshire (England)) frequency of lead water pipes in, 10, 12 and laws governing water lead in, 141–144, 145–146, 196–197 water lead and infant mortality in, 15, 62, 64–65, 69, 75 water-lead levels in, 15, 99–100, 104, 118, 129, 142, 163, 187, 196 (see also Bacup (England); Huddersfield (England); London; Sheffield (England); Yorkshire (England); Water lead, historical levels of) Eugenics. See Oliver, Sir Thomas

Fenner, Erasmus, 25–30

Gallagher, Joseph P., 150–152, 158, 167 Galler, Michael, 1–8, 152, 153 Germ theory of disease, 22, Glasgow, 10, 13, 75, 80, 110, 169, 190, 198, 199, 200, 202. See also Loch Katrine; Loch Katrine aqueduct cholera in, 175, 176, 193–194 discovery of high water-lead levels in, 194-197 housing conditions in, 170 industrialization in, 172 and Irish immigration, 173 local politics in, 176–178 mortality rates in, 169-170, 174-175, 182, 193–194 municipally owned utilities in, 177– and municipal socialism, 177, 178, 181 - 184population in, 170, 172, 173 wages in, 174 water supply before 1850 in, 170-

172, 174-175

water treatment in, 195–196 (see also Water treatment)
Glasgow Water Company, 170, 171, 177, 178, 180, 192–193
Gorbals Water Company, 172, 178, 180, 181, 188, 189, 192–193
Great Britain, 10, 20, 112, 159. See also England; Scotland; Wales
Greene, E. M., 71

Hall, Arthur, *53*, *56*Hamilton, Alice, *34*Holland, Eardley, *79*Horsford, Eben, *70–72*Household water filters, *83–84*, *146–149*, *162*, *165*Huddersfield (England), *83–84*, *138*, *141–144*, *147*

Illinois, 129–130. See also Chicago

Industrial Revolution, 20, 21, 172, 173, 174, 206
Infant morality, 19, 22, 30, 113, 203. See also Spontaneous abortions; Stillbirths and age of lead water pipes, 232–235 and lead exposure in animals, 65–66 and water hardness, 62, 227, 230–232 and water lead in England, 15, 62, 64–65, 69, 75, 203, 235–242 and water lead in Massachusetts, 15, 60–62, 69, 75, 209–229
Infectious diseases, 17, 93–94, 112–113, 122

Jones, Robin Russell, 197 Journal of the American Medical Association, 109, 166

Kingsbury, George H., 7, 8 Kirker, Gilbert, 127

Lancet (The), 19, 47, 63, 101, 159, 195, 197 Lanphear, Bruce, 32, 49, 263n85

Lead, 2, 3, 15, 22. See also Lead poisoning; Lead water pipes; Water lead as an abortifacient, 15-16, 51-53 (see also Abortifacient equivalent; Abortion pills) and blood-brain barrier, 44-45 bone stores of, 39 complex, non-linear relationship with human health, 32, 37–38, 47–50, 196, 263n11 cumulative poison, 30, 82–83, 109– 110, 100–102, 104 effects of, on human DNA and RNA, 44 mobilization of, during pregnancy, 38-40,82mobilization of, as a result of diet, disease, and exercise, 93 multisystemic effects of, 30 and placental barrier, 44, 65 and soda fountains, 25-27 toxicology of, 31 (see also ALAD; Calcium; Magnesium; Oxidative stress; Zinc) Lead cisterns, 10, 12, 13, 25-26, 128, 186 Leaded gasoline, 15, 23 Lead paint, 15, 23, 47, 66 Lead poisoning, 13, 22, 23. See also Lead; Lead water pipes; Water lead and alcohol consumption, 46, 151 in the ancient world, 22 and anemia, 31, 35, 43, 129 and animal experiments, 45, 46, 65-66, 93, 110, 121–122 biochemistry of (see ALAD, Calcium; Magnesium; Oxidative stress; Zinc) and cardiovascular disease, 33, 37, 195 cases of water-related, 4, 6, 7, 26, 71, 99–105, 110–111, 117–121, 129, 141-142, 144-145, 159-161, 163-166 (see also Alderson, James; Brown, John; Porritt, Norman; Swann, Alfred; Thresh, John C.)

and child development, 31, 32, 42, 63, 195 difficulty diagnosing low-grade, 4-7, 17, 21, 35, 106–112 difficulty diagnosing water-related, 99–105, 110–112, 119–120, 123, 129, 138, 144, 145, 159–160 and environmental deprivation, 35, 121 - 122and fetal development, 36–38, 60–61 (see also Abortion pills; Infant mortality; Lead, effects of, on human DNA and RNA; Lead, and placental barrier; Oliver, Sir Thomas, and eugenics; Spontaneous abortions; Stillbirths) genetic determinants of individual vulnerability to, 35, 121 idiosyncratic effects of, 27-29, 30, 33, 35, 105, 121–122, 145 and immune system, 33-34, 45-46 and IQ, 32, 42 and kidney function, 31, 45-46 and liver function, 31, 35, 45–46 and nutrition, 36, 43, 260-261n43 reluctance of physicians to diagnose water-related, 128 and reproductive health, 23, 36, 42, 49, 64, 120–121 (see also Eclampsia; Water lead and infertility; Oliver, Sir Thomas, and eugenics; Swann, Alfred) seasonal variation in, 27, 29, 258n10, 259n18 silent epidemics of water-related, 113–117 (see also Porritt, Norman) symptoms of, 3, 6, 7, 17, 25, 34, 35, 71, 107–108, 116 (see also Lead poisoning, cases of water-related) Lead service pipes. See Lead water pipes Lead solvency. See Doctrine of protective power; Water hardness, and lead solvency; Water lead, determinants of Lead water pipes. See also Lead; Lead poisoning; Water lead

abandonment of, 6, 202–204 adult health used to assess safety of, 16, 17, 62, 72, 75, 110, 115–116, 123, 149, 201 age of (see Water lead, and age of lead pipes) in the ancient world, 63, 150–151, consumer denial of risks of, 165consumer misinformation regarding safety of, 18, 141, 150–162, 166– consumer preference for, 18, 83, 141 cost of, 18, 83, 135, 137, 139-140, 151, 197, 201 definition and description of, 10 durability of, 18, 151-152, 201-202 and engineers, 123, 136, 138, 151– 152, 162, 189, 202 (see also Engineering News; New England Water Works Association; Thomas, frequent use of, 10-12, 138-140, 167, 201 length of, 10, 25, 166, 257n4 local ordinances mandating use of, 18, 141–144, 152, 164 more frequent in large cities, 10 and ownership of local water system (public or private), 197–200 physician opposition to, 6, 163–164, 196-197 (see also Adams, Horatio; Jones, Robin Russell; Kingsbury, George; Porritt, Norman; Swann, Alfred) physician support of, 7-8 (see also Reese, Meredith) plumber support of (see Gallagher, Joseph P.) safety as situation-specific, 13, 14, 16, 22, 201 in specific places (see Boston, Chicago, etc.) substitutes for, 6, 14, 137, 140, 143, 146-147, 152, 164, 201

Lime dosing. See Water treatment Lindsay, Lauder A., 104, 129 Linenthal, Harry A., 109–111 Loch Katrine, 180. See also Glasgow; Loch Katrine aqueduct beauty of, 169 lead solvency of water in, 169, 184-190, 194–197, 202 proximity of, to Glasgow, 169, 179 purity of, water, 169, 179, 181, 182, 185, 194 Loch Katrine aqueduct, 180. See also Glasgow; Loch Katrine effect of, on mortality in Glasgow, 169, 182, 193, 194 complexity of, 181, 191, 194 construction of, 181 cost of, 169, 181, 192 as a model of municipal socialism, 169, 191, 202 promoters of, 178, 179, 180 London, 35, 84, 133, 176 cost of waterworks in, 192 safety of lead water pipes in, 13, 14, rarity of eclampsia in, 80, 89–90 use of lead water pipes in, 10 water hardness in, 89, 125 London doctrine. See Doctrine of protective power Lowell (Massachusetts) abandonment of lead water pipes in, 161 - 162decision to install lead water pipes, early history of water-related lead poisoning in, 163-164 epidemic of water-related lead poisoning in, 160-162 and Massachusetts State Board of Health, 160-162 water-lead levels in, 54-58, 160, 161 Lowell Daily Sun, 158, 159, 160 Magnesium, 38, 41, 45, 59, 124, 206

Maine, 130

Massachusetts, 15, 16, 20, 22, 69, 125, 133, 148, 165 efforts to reduce water lead in, 144, 161, 202, 203 lead solvency of water in, 129, 139 silent epidemic of water-related lead poisoning in, 113–117 use of lead water pipes in, 138-140 water lead and infant mortality in, 15, 60–62, 95, 209–229 water-lead levels in, 54-59, 73, 74, 75, 110, 117, 144, 161, 203–204 (see also Amherst (Massachusetts; Boston; Lowell (Massachusetts); Milford (Massachusetts); Milton (Massachusetts); Worcester (Massachusetts)) Massachusetts State Board of Health, 56, 60, 70, 73, 74, 144, 145, 159-162, 202 McClintock, James, 157–158 McNeill, William, 176–177 Milford (Massachusetts), 73–75, 198– 200 Milligan, Ernest, 64–65 Mills, E. J., 194–195 Milnes, John Jessup, 141–144 Milton (Massachusetts), 144–145 Milwaukee, 205 Miscarriages. See Spontaneous abortions Moore, Michael R., 47-48, 195-196 Mortality transition, 22 Municipal socialism, 18, 200, 202 continuing appeal of, 197 in Glasgow, 177, 178, 181–184 historical evidence against, 198-199 theoretical arguments against, 197-198 Murray, Leith, 79

Needleman, Herbert, 261n54, 261n52, 270n46 New England Water Works Association, 146, 152 New Hampshire, 105, 202, 203 New Orleans, 25–28 New York City, 1-2, 60, 157-158. See also Croton water supply cost of waterworks, 191-192 introduction of water treatment in, 5, 75, 198–200 lead water pipes in, 3-6, 150 tin-lined water pipes in, 152-155 (see also Ellet, William H.; Reese, Meredith) water-lead levels in, 5, 6, 124, 146, 186–187, 204 New York Herald, 3-4 New York Times, 3, 5, 153, 155 New York Tribune, 153 Nichols, James R., 125–126, 128

Oliver, Sir Thomas and diagnosing lead poisoning, 107 and eugenics, 66–69 and idiosyncratic effects of lead, 35 Oxidative stress, 41, 46–47

Paris, 10, 13, 14, 151 Penny, Frederick, 184–188, 194, 195 Philadelphia, 124, 158, 186, 205 Porritt, Norman, 19, 20, 23, 92–93, 103, 111–112, 122, 123. See also Eclampsia career of, 83 lasting significance of work of, 95-97 publications of, 19, 83 and the relationship between water lead and eclampsia, 19, 83–91 skepticism of, regarding prevailing theories of eclampsia, 89-91 and "slow and subtle" forms of lead poisoning, 99-101 social isolation of, 121-122 and use of household water filter, 99and use of tin-lined pipes, 146–147

Plumbosolvency. See Doctrine of protective power; Water hardness and lead solvency; Water lead, determinants of Putnam, James J., 113–114

Rantoul, Eleanor, 114–117 Reese, Meredith, 8, 154–158

Sappington, Clarence O., 114–117 Scotland, 49, 80, 186, 187, 193, 196, 204, 257n4. See also Aberdeen (Scotland); Edinburgh; Glasgow (Scotland) Scott, Sir Walter, 169, 182 Sheffield (England), 10, 77–78, 105, 137, 147, 187 epidemic of water-related lead poisoning in, 162–163 Smallpox, 69 Soda fountains. See Lead, and soda fountains Spontaneous abortions. See also Infant mortality; Stillbirths and lead exposure, 30, 37, 38, 66, 67, 69 and water lead, 36, 62–65, 72, 113, 120, 121 Stainthorpe, W. W., 64–65, 108–109 Steckel, Richard, 206 Stillbirths, 15–16, 30, 66, 67 and lead exposure, 36-38, 65 and water lead, 62, 64, 69, 75, 113, 159, 209-229 Swann, Alfred, 19, 23, 36, 62–65, 75, 201

Theobald, G. W., 80–81, 89 Thomas, R. J., 161–164 Thomson, William, 104–105 Thresh, John C., 72, 129, 132, 190 Tin-lined pipes, 137, 146–147, 152–155 Typhoid fever, 6, 69, 112–113, 138, 193, 197 Urine lead, 84, 99–101, 114 as an unreliable indicator of lead poisoning, 107

Vitruvius, 63, 158

Wales, 65, 78, 84, 86–93, 159, 187, Washington, D.C., 13, 191, 205, 206 Water hardness. See also Infant mortality and and cardiovascular disease, 206 and incidence of lead water pipes, 138-140, 201-202 and lead solvency, 17, 56, 59, 83, 84, 86–87, 124–125, 129–132, 135, 136, 140, 201–202, 251–253 (see also doctrine of protective power; Loch Katrine, and lead solvency of water; Water lead, determinants of) Water lead. See also Lead; Lead poisoning; Lead water pipes and acid rain, 127, 205 and age of lead pipes, 17, 59–60, 117, 123–125, 195, 202 and alkalinity, 131–133, 272n22, 272n23 in the ancient world, 63, 150-151, 158 awareness of, 16, 99-105, 120-121 and blood lead, 47-50, 195-196 as a cause of disease and pathology (see Eclampsia; Infant mortality; Lead poisoning, cases of waterrelated; Spontaneous abortions; Stillbirths; Water lead, and convulsions; Water lead, and infertility) and changes over time, 6, 202-204 and CO₂ levels, 56, 133–136 and convulsions, 93-94, 118, 160, 248 - 250current legal thresholds for, 5, 14, 195–196

current levels of, 5, 6, 195–196

Water lead (cont.) determinants of levels of, 16, 28, 83, 126-136, 251-253 (see also Doctrine of protective power; Water hardness, and lead solvency) difficulty predicting, 123, 125-136, 140, 153, 251–253 estimated number of people affected by, 115, 116, 117, 122, 126–127, 159, 190 evolution of legal threshold for, 203geographic variation in, 16, 23, 83– 89 historical levels of, 5, 6, 13, 14, 26, 54–57, 99–100, 104, 110, 117, 129–132, 142, 144, 163, 204, 265n38 (see also Boston, England, Massachusetts, etc.) historical recommended thresholds for, 74, 144, 161, 166, 187–188, 204 household methods of reducing, 83-84, 146–150, 162, 165 and infertility, 36, 62–63 (see also Swann, Alfred) legal liability for excess of, 18, 141-145, 148–150, 165, 167–168, 202 as a minor public health problem, 17, 63, 69, 112–113, 151, 166–167, 201 and privatization of urban water systems, 197–200 in standing water, 5, 6, 13, 54–57, 134–135, 148 and water treatment (see Water treatment, efficacy of) Waters, Ernest E., 81, 82 Water softness. See Water hardness Water treatment cost of, 18, 137–138, 148, 185, 199, 273n34 efficacy of, 18, 74, 84, 137–138, 162, optimal techniques, situation specific, 137 - 138

slowness of cities to adopt, 5, 15, 73-75, 198–199 techniques, 73-74, 137-138 (see also Water lead, household methods of reducing) in specific places (see Glasgow; Huddersfield (England); Milford (England); New York City) Welsh, James and Louisa E., 145 Wedekind, August, 1–3 White, Sinclair, 105, 147 Whitsell, F. M., 166–168 Worcester (Massachusetts), 102–103, World Health Organization, 195–196 Wright, Wade, 114–117 Yellow fever, 112–113 Yorkshire, 16, 83, 90, 127, 137, 162-

Zinc, 38, 44, 45, 50, 140 and human reproduction, 42–43 lead's ability to supplant, 42–43

water lead and stillbirths in, 67