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Resnik, D. B. 2012. *Environmental health ethics*. Cambridge, UK: Cambridge University Press.

Resnik, D. B. 2014. Ethical issues in field trials of genetically modified disease-resistant mosquitoes. *Developing World Bioethics* 14 (1):37–46.

Resnik, D. B. 2017. Ethics of community engagement in field trials of genetically modified mosquitoes. *Developing World Bioethics*. 2017 May 3. doi: 10.1111/dewb.12147 [Epub ahead of print]

Servick, K. 2016. Winged warriors. *Science* 354 (6309):164–167.

World Health Organization. 2014. *Guidance framework for testing of genetically modified mosquitoes*. Geneva, Switzerland: World Health Organization.

Environmental Neuroethics: Bridging Environmental Ethics and Mental Health

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As noted by Lee (2017), this is a time of unprecedented human influence on global ecosystems. In the 1960s, scientists proposed the term Anthropocene to refer to the epoch during which human activity became the dominant influence on the climate and environment. Scholars are still debating when the Anthropocene epoch began, but regardless of the starting date, it is clear that anthropogenic influences on the environment are not merely continuing, but in fact accelerating. In turn, the changes humans have induced in the environment are reverberating through sometimes subtle but frequently profound environmental effects on human health. We agree with Lee that these effects challenge society to grapple with ethical perspectives that take into account the value of ecosystems, of other animals, and of current and future human populations. We build here on Lee's proposal by highlighting one particular area at the intersection of environmental ethics and bioethics that is in need of further research: environmental neuroethics (Illes, Davidson, and Matthews 2014; Cabrera et al. 2016).

Environmental neuroethics examines the many ways in which anthropogenic influences on the environment affect brain health and mental well-being. It builds upon the field of neuroethics that situates ethical, legal, policy and social considerations alongside technological developments in the neurosciences. The term "neuroethics" was initially used by William Safire to refer to ethical issues associated with the "treatment and enhancement of the human brain" (Marcus 2002), but the field has expanded in scope as it has become increasingly clear that the changing understanding of the brain is having a profound influence on many aspects of human life. As such, the field of neuroethics is responsive to the ways in which an evolving understanding of the brain interacts with the transformative processes shaping the future. There is little doubt, moreover, that the impact that humans are having on the environment is one of those transformative processes of our time. Discussions of the ethical and societal consequences of environmental change for brain and mental health have thus far been limited, but given the vulnerability of the central nervous system to environmental factors, the time is now for the field of public health to embrace the topic.

We consider two contemporary examples of importance to public health to highlight the ethical challenges raised by environmental impacts on brain and mental health: pesticides and exposure to lead. It has long been known that pesticides can have detrimental effects on wildlife, can be toxic for nontarget plants and animals, and thereby can adversely impact nearby and downstream ecosystems. The consumption of pesticides can also have adverse effects on human health and, particularly important for our purposes, has been associated with brain changes related to autism, aging, and neurodegeneration (Pearson et al. 2016).

The potential adverse effects of pesticides on brain health raise several important neuroethics challenges (Cabrera 2017). The neurotoxic effects of pesticides are particularly pronounced on various vulnerable populations. Some pesticides can cross the blood–brain barrier and damage the brains of fetuses. Prenatal pesticide exposure has been associated with working memory deficits, IQ reduction, and decreased behavioral competence in children. Increased exposure risks continue throughout childhood, as the developing nervous system is particularly prone to disruption. These challenges are further

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compounded by socioeconomic factors, as lower income groups are more likely to be exposed to pesticides in daily life and less likely to be aware of potential harmful effects of pesticides (Dinham and Malik 2003).

As such, an ethical evaluation of the impacts of pesticides on brain health must be situated at the nexus of a complex set of issues involving discrepancies in exposure, knowledge, and access to alternatives among different populations. Importantly, the neurological impacts on developing children are also likely to have effects that extend far into the future, which raises questions related to the concerns of environmental ethicists about duties to future generations. Environmental ethicists have written a great deal about the various ways modern choices can negatively impact the well-being of people in future generations. As the case of pesticides highlights, it is also important to consider the implications of adverse effects on brain health, which not only decrease the well-being of future generations but perhaps also diminishes the ability, in democratic societies, to effectively respond to pressing challenges.

The influences of lead exposure on the brain also raise an important set of environmental neuroethics challenges. The Kennedy Krieger research on lead paint exposure is a classic case study for bioethicists (Buchanan and Miller 2006). More recently, in 2015, people across North America were rightfully outraged when it was revealed that residents of Flint, Michigan, were exposed to high levels of lead in their drinking water as a result of the decisions of an unelected government official looking to save costs. This was a terrible failure of responsibility exacerbated by the systematic dismissal of prior concerns articulated by Flint residents. Despite the attention the Flint crisis received, many people across North America continue to get their drinking water from lead pipes today, and worldwide the World Health Organization estimates that 40% of children have elevated blood lead levels. In addition to exposure from water sources, the general population can be exposed to lead through the air, contaminated soil, and lead-based paint.

Exposure to lead is correlated with decreased IQ scores and attention spans, and, similarly to pesticides, these effects are exacerbated when the exposure occurs during early development. One particularly challenging set of issues is raised by the mounting evidence of a connection between increased exposure to lead and criminal behavior (Reyes 2007). This work brings to the foreground the question of how society should calibrate its understanding of criminal responsibility in individuals and across populations that have been affected by societal failure to address lead exposure.

As Lee highlights so well, this is a time in which the reverberating effects of human influences on the environment can no longer be ignored. The field of environmental neuroethics represents an important step in the holistic understanding of the relationship between the environment and human health. We join Lee in advocating for the integration of environmental concerns into public health, and we hope that others will take up the cause.

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REFERENCES

Buchanan, D. R., and F. G. Miller. 2006. Justice and fairness in the Kennedy Krieger Institute lead paint study: The ethics of public health research on less expensive, less effective interventions. *American Journal of Public Health* 96 (5):781–87. http://dx.doi.org/10.2105/AJPH.2005.063719.

Cabrera, L. Y., J. Tesluk, R. Matthews, M. Chakraborti, and J. Illes. 2016. Brain matters: From environmental ethics to environmental neuroethics. *Environmental Health* 15:20–25.

Cabrera, L. Y. 2017. Pesticides: A case domain for environmental neuroethics. *Cambridge Quarterly of Healthcare Ethics* 26 (4).

Dinham, B., and S. Malik. 2003. Pesticides and human rights. *International Journal of Occupational and Environmental Health* 9 (1):40–52.

Illes, J., J. Davidson, and R. Matthews. 2014. Environmental neuroethics: Changing the environment—Changing the brain. Recommendations submitted to the Presidential Commission for the Study of Bioethical Issues. *Journal of Law and the Biosciences* 1 (2):221–23. http://dx.doi.org/10.1093/jlb/lsu015.

Lee, L. M. 2017. A bridge back to the future: Public health ethics, bioethics, and environmental ethics. *American Journal of Bioethics* 17 (9):5–12.

Marcus, S. 2002. *Neuroethics: Mapping the field*. San Francisco, CA: Dana Press.

Pearson, B. L., J. M. Simon, E. S. McCoy, G. Salazar, G. Fragola, and M. J. Zylka. 2016. Identification of chemicals that mimic transcriptional changes associated with autism, brain aging and neurodegeneration. *Nature Communications* 7:11173.

Reyes, J. W. 2007. Environmental policy as social policy? The impact of childhood lead exposure on crime. *B.E. Journal of Economic Analysis & Policy* 7 (1):article 51.