



Environmental neuroethics: changing the environment—changing the brain

Recommendations submitted to the Presidential Commission for the Study of Bioethical Issues

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Environmental neuroethics situates the field of neuroethics¹ at the intersection of some of the leading transformatory processes of our time.

The world is experiencing sweeping changes today in ecology and society related to the impact of industry arising from the continually expanding worldwide human demand for energy, new products, and a technologically advanced lifestyle. Prime among these environmental impacts are climate change and water deterioration.² Though climate change is generally examined in terms of scientific measures, it should primarily be thought of as a social condition.³ Its causes are largely due to human behavior, and whether people can mitigate its effects or adapt to them will require a restructuring of current social, political, and cultural institutions, and related behaviors. Similarly, in part because of climate change and in part because of the effects of industry, the availability of clean water for human consumption is rapidly being depleted, particularly in

¹ JUDY ILLES (ed.) *NEUROETHICS: DEFINING THE ISSUES IN THEORY, PRACTICE AND POLICY* (2006).

² Intergovernmental Panel on Climate Change, <http://www.ipcc.ch/report/ar5/index.shtml> (accessed May 20, 2014).

³ United Nations Task Team on Social Dimensions of Climate Change, *The Social Dimensions of Climate Change, Discussion Draft*, https://www.iom.int/jahia/webdav/shared/shared/mainsite/activities/env_degradation/cop17/SDCC-Social-dimensions-of-climate-change-Paper.pdf (accessed May 20, 2014).

arid regions of North America, Africa, and Asia.⁴ Of note is that both the surface water and the aquifers built up underground over thousands of years are now threatened.⁵

Over the past two decades, the impact of climate change and the deterioration of available water resources have intersected with new ways of accessing carbon-based energy. The technological process known as hydraulic fracturation or ‘fracking’ has led to the profitable development of formerly inaccessible gas resources, particularly in North America and Australia, and also in China and Europe.⁶ Indeed, gas resources available through fracking are now believed to be able to provide the world with enough carbon-based energy for the next 200 years. Fracking uses a combination of high pressure water, sand and chemicals, and new drilling techniques to release pockets of natural gas usually at depths exceeding 2000 feet below the surface. Not only does this place enormous stress on the available water resources, but approximately 40 per cent of the fracking mixture returns to the surface to provide another potential source of water contamination.⁷ In addition, leakage of gases such as methane and CO₂ can exacerbate the level of greenhouse gas release and thereby have negative climate impacts.

This is not the place to debate the pros and cons of fracking, other types of industrial water utilization, or the causes of climate change. However, it is highly probable that fracking, like many other industrial activities, not only has environmental impacts, but also significant human health impacts.^{8,9} While the physical effects of these processes, such as asthma and cardiovascular disease, have begun to receive some attention in the professional academic literature,^{10,11} there is still little consideration of them in the neurological health literature or in work that directly examines the impact of such environmental processes on mental health. This was no more evident than in a recent study that looked at Early Onset Familial Alzheimer Disease in a First Nation family in Canada (Brief and Illes 2010; Stevenson et al. 2013). Given this, our submission to the *Presidential Commission for the Study of Bioethical Issues* proposed the consideration of a new trajectory for neuroethics—environmental neuroethics—with a focus on the challenges specifically affecting brain health and illness.

⁴ Food and Agriculture Organization of the United Nations (2012), *Coping with water scarcity. An action framework for agriculture and food security*, <http://www.zaragoza.es/contenidos/medioambiente/onu//newsletter12/880`eng.pdf> (accessed June 25, 2014).

⁵ C.P. Kumar *Climate Change and Its Impact on Groundwater Resources*, 1 INT’L J. ENG’G SCI. 43 (2012).

⁶ Council of Canadian Academies (2014). *Environmental Impacts of Shale Gas Extraction in Canada*. The Expert Panel on Harnessing Science and Technology to Understand the Environmental Impacts of Shale Gas Extraction. Council of Canadian Academies. <http://www.scienceadvice.ca/uploads/eng/assessments%20and%20publications%20and%20news%20releases/Shale%20gas/ShaleGas.fullreportEN.pdf> (accessed June 25, 2014).

⁷ Tom Myers, *Potential Contaminant Pathways from Hydraulically Fractured Shale to Aquifers*, 50 GROUNDWATER 872 (2012).

⁸ Roxana Witter et al., *Potential Exposure-Related Human Health Effects of Oil and Gas Development: A Literature Review (2003–2008)*. Denver, CO: Colorado School of Public Health (2010).

⁹ Bernard D. Goldstein, Jill Kriesky & Barbara Pavliakova, *Missing From the Table: Role of the Environmental Public Health Community in Government Advisory Commissions Related to Marcellus Shale Drilling*, 120 ENVTL. HEALTH PERSPECTIVES 483 (2012).

¹⁰ Lorenzo Cecchi et al., *Projections of the Effects of Climate Change on Allergic Asthma: The Contribution of Aerobiology*, 65 ALLERGY 1073 (2010).

¹¹ Wilbert S. Aronow & Chul Ahn, *Elderly Nursing Home Patients with Congestive Heart Failure after Myocardial Infarction Living in New York City Have a Higher Prevalence of Mortality in Cold Weather and Warm Weather Months*, 59 J. GERONTO. A BIOL. SCI. MED. SCI. 146 (2004).

In proposing this new trajectory for neuroethics, we emphasize that it will require the linking of disciplines not often brought into direct engagement with one another. Most notably, it will require input related to neurological sciences with ecology, climate science, engineering, environmental and regulatory law, and social science. That is, the assessment of both the impact and ethical issues involved requires a broad interdisciplinary understanding of technical issues in environmental, physical, and chemical science, together with health and social sciences fields. The challenges faced in providing this new interdisciplinary analysis to the biosciences ethics are enormous. However, these are core challenges with which we must engage.

Our call and encouragement for environmental neuroethics, submitted in answer to the Bioethics Commission's call for comments,¹² appears below.

¹² Request for Comments on the Ethical Considerations of Neuroscience Research and the Application of Neuroscience Research Findings, Federal Register, 31 January 2014, <https://www.federalregister.gov/articles/2014/01/31/2014-02072/request-for-comments-on-the-ethical-considerations-of-neuroscience-research-and-the-application-of> (accessed May 20, 2014).