Environmental Ethics in an Ecotoxicology Laboratory

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Introduction

The move towards engaging ethicists on the laboratory floor as an approach to encouraging responsible research and innovation has focused largely on engaging with scientists actively involved in technology development. The case study described in this chapter adopts a slightly different orientation. The laboratory at the centre of this case study is not engaged in research oriented towards creating technological development, but rather in conducting research on the potential risks posed by technological development. More specifically, it is a laboratory conducting ecotoxicological research to understand the environmental effects of genetically-modified organisms (GMOs) and their associated pesticide regimes. As such, it performs research specifically intended to inform decision-making on new and emerging technologies, and support responsible use and applications of such technologies. This means that, although it is not research directly aiming to develop new technologies, it is research that actively shapes those technologies through the way it informs industry developments, risk assessment, regulation, governance and public opinion.

Environmental toxicology, or ecotoxicology,\(^1\) began as a field of research to assess the effect that different chemicals (and particularly those from industrial waste discharges) would have on the environment (Cairns Jr 1995). The primary method to perform such research is to expose a set of standardised indicator species to selected individual chemicals in varying concentrations over short periods of time, documenting effects on factors such as mortality, growth, reproductivity or, less commonly, behaviour. The results from such experiments are then extrapolated using safety factor multiplications to infer the level
of potential harm posed by the chemical in question for all non-target organisms. This type of research forms the knowledge base for processes of environmental risk assessment, which, in turn, represents the main decision-aiding tool for regulatory authorities.

The toxicological approach to understanding environmental harm is now extended to the environmental effects of new technologies, including those related to GMOs. The use of toxicological approaches for understanding the environmental effect of GMOs has, however, been contested owing to concerns relating to the adequacy of transferring a paradigm developed to understand environmental effects from chemicals to those from living organisms (Andow and Hilbeck 2004). This is not only because of the dynamic and reproductive possibilities of living organisms, but also owing to questions surrounding the relevance of a universal set of indicator species for understanding environmental harm, particularly for specific local contexts and conditions. The indicator species that have been standardised for ecotoxicology and environmental risk assessment have been chosen because of their ease of cultivation in a laboratory, their chemical sensitivity, their genetic uniformity and their wide availability, rather than, for example, their ecological functionality, their social significance or their relevance to the geographical location in question (Andow and Hilbeck 2004; Chapman 2002). That said, the knowledge developed through ecotoxicological models and methods remains widely accepted, and, indeed, required for regulatory decision-making on new and emerging technologies.²

Toxicology generally, and ecotoxicology more specifically, represent a particular form of science that is oriented specifically towards informing policy, which Jasanoff (1990) refers to as a ‘regulatory science’ and Demortain (2011) calls an ‘evaluative science’. These are sciences conducted specifically for the purpose of meeting legally mandated regulatory standards. While ecotoxicology plays a formal role in political decision-making on emerging technologies through providing the necessary knowledge base for established decision-making processes, such as environmental risk assessment, it is also important for governance more broadly. This is because ecotoxicology is both developed and used by other actors, such as industry and environmental non-governmental organisations, as evidence for assessing the desirability of pursuing particular technological trajectories. Ecotoxicology therefore plays a significant role in shaping both social and political understandings of environmental harm relating to new and emerging technologies, and influences how these technologies are understood, managed, controlled and governed within the industries that are developing them, the