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**Environmental Ethics and Biotechnology:
A Test of Norton's Convergence Hypothesis**

by
Marc A. Saner

**A thesis submitted to the Faculty of Graduate Studies and Research
in partial fulfilment of the requirements for the degree of**

(Master of Arts)

**Department of Philosophy
Carleton University
Ottawa, Ontario**

4 May 1999

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and Research acceptance of the thesis

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submitted by Marc A. Saner
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Thesis Supervisor (Prof. J. Drydyk)

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ABSTRACT

Bryan Norton's Convergence Hypothesis asserts that environmentalists "of all stripes" can achieve consensus over environmental policy if only minimal constraints are applied to the dialogue. Norton challenges that his proposition has not been falsified as yet (as of 1997). I test the hypothesis against the dialogue over the environmental use of biotechnology (genetic engineering). I discuss the environmental ethical issues raised by biotechnology and show that the Convergence Hypothesis is either *unreasonable* — applying its constraints to a environmental policy dialogue is too restrictive for environmental radicals, or can be *falsified* — applying its constraints does not lessen the divergence between positions in the dialogue over biotech policy. I conclude that the Convergence Hypothesis is an over-generalization: the global claim of "unity among environmentalists of all stripes" cannot be upheld.

I discuss practical consequences of this observation — how it affects risk management (and the risk/ethics boundary), biotech risk communication, the comprehensiveness of the ecosystem health concept, and the application to international agreements.

DEDICATION

To Heather — Thanks!

ACKNOWLEDGMENTS

I could not have completed this thesis without the support of many people. To the following I am especially grateful. I am very much indebted to my supervisor, Jay Drydyk, for clear, competent and timely advice, and for being available whenever the need arose. Special thanks also to Will Kymlicka for commenting on a draft version of the thesis and for taking on the tasks of secondary reader and an examiner. Numerous discussions with Joe McDonald helped me to understand how my work fits into the wider field of philosophy — these discussions were highly informative and motivating. Many thanks to Terry McIntyre for being willing, on short notice, to serve as an external examiner. I am indebted to Andy Brook for immediately taking the time to provide comments on the second draft of the thesis and to Bill Leiss who provided comments on the thesis proposal. Myron Smith, Jacqui Whiteway, and Brian Belliveau provided me with suggestions on Tables 1 and 2, for which I am thankful. The e-mail exchange with Christina Aus der Au and her detailed comments on my workshop paper were very helpful. Holly Mitchell and Elizabeth Baker provided me with useful information.

My participation at a workshop convened by Elisabeth Boetzkes at McMaster University (2-4 October 1998) — *The Ethics of Human Health and Ecosystem Health: Toward an Inclusive Understanding* — was the highlight of my thesis work. I am grateful to the workshop participants and for suggestions by Conrad Brunk, Val Plumwood, Ingrid Stefanovic, James Sterba, and Laura Westra. Thanks also to the participants of the First Annual Student Symposium of the Carleton University Philosophy Society (5 February 1999) and to Madeleine Arseneault for organizing this event.

A special thank-you to Annette Lee for getting me interested in environmental ethics, for teaching an excellent course and for follow-up support. Denis Dumas' course in environmental ethics further convinced me about the utility and interest that this field provides. Thanks also to the faculty at the Philosophy Department at Carleton for being very accessible and helpful. It has been a pleasure to share an office and discuss many issues with Marin Gillis. Andrea Casciato and Heather Dewar patiently proofread various drafts of the thesis. Philippe and Oliver endured many supper-time musings about philosophical issues. I thank everybody for their support.

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THE CHALLENGE: NORTON AND THE IDEA OF CONVERGENCE

In 1997 Bryan Norton stated the following in the journal *Environmental Ethics*:

[C0]¹ The convergence hypothesis is a contingent truth; a very general empirical hypothesis that shapes solutions sought by adaptive managers in particular situations. It is supported by facts, both directly and indirectly; it could be falsified, *but so far it has not been.*² [Emphasis added]

I perceive this statement as a challenge. This thesis is an attempt to address this challenge to falsify Norton's hypothesis.

Norton has been developing his convergence project for more than a decade. His efforts culminated in his book *Toward Unity Among Environmentalists*³ and more recently in a clarified formulation of the Convergence Hypothesis in the article that contained the challenge addressed in this thesis. In very general terms the convergence hypothesis states that unity among environmentalists is possible *at the policy level* even if their underlying theoretical ethical positions diverge. Norton specifies two rules that ought to be followed for convergence to take place. One of these rules applies to "resource managers", who tend to be conservative environmentalists, and the other rule applies to "environmental radicals".

The term 'convergence' is to be understood as meaning agreement among environmentalists, a form of consensus over environmental policy. It is not to be confused

¹ Throughout this thesis quotations addressing the Convergence Hypothesis are numbered in the format 'Cx'.

² Bryan Norton, "Convergence and Contextualism: Some Clarifications and a Reply to Steverson," *Environmental Ethics* 19 (1997): 87-100. Quote on p. 99.

³ Bryan Norton, *Toward Unity Among Environmentalists* (New York: Oxford University Press, 1991).

with ‘coherence’; no claim is made that the Convergence Hypothesis addresses the consistency, orderly continuity, arrangement, or relevance of ethical positions.

Norton proposes this hypothesis as an alternative to what is implied by the divisive terminology used in one of the central debates within environmental ethics, namely, the unresolved debate between ‘anthropocentrists’ and ‘non-anthropocentrists’. It suggests that they cannot agree on policy directions. Anthropocentrists consider only the interests of humans while non-anthropocentrists also consider non-human entities in moral deliberations. To better illustrate this point I provide here a very short sketch of the debate over moral considerability in environmental ethics.⁴

Traditional ethics are anthropocentric — only human individuals have moral standing and are being considered in moral deliberations. Critics have replied that species membership is not a compelling criterion for moral standing and — in analogy with racism — have dubbed this anthropocentric view “speciesism”.⁵ Speciesism can be avoided if one attributes moral standing to all human or animal individuals who can experience pain and suffering. This view, however, has been criticised as a similarly discriminatory

⁴ In this thesis I understand ‘environmental ethics’ in the two ways defined by Joseph Des Jardins: “In general, environmental ethics is a systematic account of the moral relations between human beings and their natural environment.” ... “In [a] sense, environmental ethics is a branch of philosophy involving the systematic study and evaluation of normative judgements that are so much a part of environmentalism.” *Environmental Ethics: An Introduction to Environmental Philosophy* (Belmont, CA: Wadsworth Publishing Company, Second Edition, 1997), p. 9 and p. 17.

⁵ This term is used by Peter Singer in “All Animals are Equal,” in *Earth Ethics: Environmental Ethics, Animal Rights, and Practical Applications*, ed. James Sterba (Englewood Cliffs, NJ: Prentice Hall, 1995), p. 41.

“sentientism”.⁶ Sentientism can be avoided if one attributes moral standing to all individuals of any life form. This view, however, must rely on a complex model of adjudication among all individuals with moral standing, because it is not possible for any human individual to live without harming individuals of other life forms.⁷ Critics have also argued that any ethical view that relies solely on the consideration of *individuals* will miss the importance of observations made in the field of ecology; in particular, it will not attach sufficient importance to the empirical fact that individuals are dependent on the interconnected web of functions provided by the living and non-living entities of the ecosystem they inhabit. The goal, they then argue, is to give moral consideration to the needs of a particular ecosystem or even the totality of Planet Earth both of which may be considered to represent a ‘super-organism’.⁸

This cursory summary of certain aspects of environmental ethics illustrates that the field is highly fragmented with respect to its axiological foundations. These theoretical problems have been compounded by practical problems: environmental ethics has not been terribly effective in the political arena either. Andrew Light and Eric Katz state:

⁶ This term is used by John Rodman in “Four forms of ecological consciousness reconsidered,” in *Ethics and the Environment*, eds. Donald Scherer and Tomas Attig (Englewood Cliffs, NJ: Prentice-Hall, 1983), p. 87.

⁷ See, for example, Paul Taylor, *Respect for Nature: A Theory of Environmental Ethics* (Princeton, NJ: University Press, 1986).

⁸ These views are expressed by advocates of the land ethic, deep ecology, or the Gaia hypothesis. Further prominent environmental ethics, for example ecofeminism and social ecology, do not specifically focus on the question of moral standing and instead discuss the linkages between social justice and attitudes towards the environment.

As environmental ethics approaches its third decade it is faced with a curious problem. On the one hand, the discipline has made significant progress in the analysis of the moral relationship between humanity and the non-human world. The field has produced a wide variety of positions and theories in an attempt to derive morally justifiable and adequate environmental policies. On the other hand, it is difficult to see what practical effect the field of environmental ethics has had on the formulation of environmental policy.⁹

In the light of this important practical problem it would be desirable to increase the coherence among environmental ethical theories, and the consensus among their practical applications, as it might facilitate greater political effectiveness.

We might distinguish between three different ways in which greater coherence could be achieved at the theoretical level [terms for the corresponding strategies follow in square brackets]: (1) One of the theories may prove superior and become adopted as the dominant environmental ethical theory [**'conquest'**]. (2) The fragmentation among theories may be overcome through a method of reconciliation where elements of different ethics become incorporated into a novel monistic environmental ethical theory [**'reconciliation'**]. (3) A successful system of moral pluralism may be developed [**'toleration'**].

At the practical level greater consensus could be achieved based on these three corresponding alternatives. (1) Only one of the theories may possess the features required for the formulation of environmental policies [**'selection'**]. (2) The various theories may converge at the practical level insofar that they call for the same policies [**'convergence'**]. (3) Different theories will be considered applicable in different policy contexts [**'accumulation'**].

⁹Andrew Light and Eric Katz, "Introduction: Environmental Pragmatism and Environmental Ethics as Contested Terrain" in *Environmental Pragmatism*, eds. A. Light and E. Katz (London: Routledge, 1996), p. 1.

In this thesis I focus only on the convergence strategy. The test of Norton's Convergence Hypothesis requires three preliminary steps: (a) to understand and clarify the Convergence Hypothesis, (b) to determine whether the Convergence Hypothesis is indeed a testable hypothesis, and (c) to select a suitable test case. In this chapter I shall address the first two points. In the second chapter I shall discuss the extent to which modern biotechnology provides a suitable test case. In the third chapter I shall conduct the actual test and conclude that modern biotechnology introduces novel policy problems which are recalcitrant to the kind of convergence that Norton envisages. I shall then discuss whether or not this observation genuinely falsifies Norton's hypothesis. I conclude describing possible implications for theory and practice.

Norton's Convergence Hypothesis

The idea of convergence is present in Bryan Norton's earlier writings, before he introduces the term 'Convergence Hypothesis'. Components of the convergence project are already contained in Norton's first positive contribution to environmental ethics (as opposed to earlier critical contributions).¹⁰ Norton's starting point is a critique of the traditional assumption that an environmental ethic must be founded on a non-anthropocentric value framework. Instead, he argues, it is possible to found an environmental ethic on a special form of anthropocentrism.

¹⁰ Bryan Norton, "Environmental Ethics and Weak Anthropocentrism," *Environmental Ethics* 6 (1984): p. 131-148.

This argument requires the consideration of a critical ambiguity in the expression ‘anthropocentrism’, of which two forms should be distinguished according to Norton. “Strong anthropocentrism” refers to the form in which ‘anthropocentrism’ has been traditionally understood.¹¹ It is based on “felt preferences” that are desires or needs of a human individual which can be directly satisfied.¹² An example would be economic approaches to decision making. In contrast, “weak anthropocentrism” is based either on “felt preferences” or “considered preferences” — the latter are of intellectual nature and have the ability to override those felt preferences which are considered irrational.¹³ Considered preferences require the adoption of a specific worldview and appeal to the ideals contained in this worldview. Based on this characterization, purely exploitative ventures may be (a) supported from a strongly anthropocentric viewpoint because they satisfy felt preferences but

¹¹ Traditionally, anthropocentrism represents a view in which only humans have intrinsic value, i.e., moral standing. In this view, the human environment has only instrumental value although its value to other humans or future generations may be considered. In its purest form, humans are viewed as the centre of creation, or the top of a hierarchical natural order, having dominion over the environment. In contrast, non-anthropocentrism represents a view where intrinsic value is attributed to components of or all of the human environment. In its purest form, the similarity of an entity with humans is considered irrelevant to the question of its intrinsic value.

¹² Norton, “Environmental Ethics and Weak Anthropocentrism”, p. 134.

¹³ Norton develops these concepts further in his single-authored *Why Preserve Natural Variety?* (Princeton, NJ: University Press, 1987), e.g., p. 9-10. In this later work he distinguishes between ‘merely felt preferences’ and ‘considered felt preferences’ with the corresponding objects that have ‘demand value’ or ‘transformative value’, respectively. I do not need to discuss the further development of these concepts since I do not attempt to describe the entirety of Norton’s theoretical framework. I need to point out, however, that they are used here in the ‘historical’ context to better illustrate the emergence of the Convergence Hypothesis.

(b) rejected from a weakly anthropocentric viewpoint because they violate considered preferences.

Advocates of weak anthropocentrism, therefore, can give consideration to entities which have been traditionally considered only by non-anthropocentrists. This has two important consequences. First, there is no need to “make the questionable ontological commitments involved in attributing intrinsic value to nature”.¹⁴ Second, the consideration of individuals *and* non-individuals within weak anthropocentrism can result in an environmental ethic which is truly distinct from traditional ethics without requiring the anthropocentric vs. non-anthropocentric distinction. For example, the intrinsic value of ecosystems can be replaced by the preference to live among healthy ecosystems.¹⁵ In short, Norton discovered a way, he thinks, to formulate a true environmental ethic which is not dependent on questionable metaphysical concepts.

Norton’s next step was to base the idea of convergence on a novel interpretation of the distinction between the concepts of conservation and preservation.¹⁶ Early environmental philosophers took the term “conservation” to express the attempt to save natural resources

¹⁴ Norton, “Environmental Ethics and Weak Anthropocentrism”, p. 148.

¹⁵ Norton specifies how intrinsic value could be translated into the following four instrumental values in *Why Preserve Natural Variety?* “Use” and “option” values are demand values that represent the present and future instrumental use of ecosystems. “Existence” and “transformative” values represent the value of the existence of wild places and the value of the effect that they have on us (in terms of transforming our considered preferences). The preference to live in healthy ecosystems is based on the consideration of some or all of these four instrumental values.

¹⁶ Bryan Norton, “Conservation and Preservation: A Conceptual Rehabilitation,” *Environmental Ethics* 8 (1986): 195-220.

for later consumption. In contrast, the term “preservation” was thought to express the attempt to save species and wilderness *from* damage or destruction. These early environmental philosophers argued that a focus on conservation would entail anthropocentrism while a focus on preservation would entail non-anthropocentrism.¹⁷ Norton argues that this interpretation of the meanings of these terms emphasizes an apparent opposition between *kinds* of value systems. In contrast, Norton proposes an alternative interpretation which illustrates *degrees* of difference in the outlook between conservationists and preservationists and, therefore, emphasize commonalities. Instead of contrasting philosophical positions he contrasts the following two activities.¹⁸

... *to conserve* a resource or the productive potential of a resource-generating system is to use it wisely, with the goal of maintaining its future availability or productivity. *To preserve* is to protect an ecosystem or a species, to the extent possible, from the disruptions attendant upon it from human use [emphasis in text].¹⁹

Norton argues that this interpretation is based on the examination of the empirical bases of the concepts conservation and preservation. According to Norton, because they are engaging in these two different activities, conservationists and preservationists emphasize different criteria for ecosystem health and stability. Conservationists are drawn to the concept of ecosystem resilience which emphasizes a ‘static stability’ (i.e., the ability of a system to return to prior levels of functioning following disturbance). Preservationists are drawn to

¹⁷ Norton refers in particular to John Passmore, *Man’s Responsibility for Nature: Ecological Problems and Western Traditions* (New York: Charles Scribner’s Sons, 1974).

¹⁸ A focus on activities rather than positions represents a move away from philosophical reasoning to pragmatic considerations.

¹⁹ Norton, “Conservation and Preservation: A Conceptual Rehabilitation”, p. 200.

another criterion which could be called ‘predictability’ or ‘dynamic stability’.²⁰ By this criterion a system can be stable even through significant changes, provided that they are the results of the internal dynamic of the system (for example, a forest in early succession would be considered ‘dynamically stable’). In other words, conservationists and preservationists differ in that the former are more concerned with productivity in the short and medium run, while the latter value long-term stability more highly.

Norton’s crucial point is that a concern for long-term effects is sufficient to support preservationism while the adoption of non-anthropocentrism is not a necessary condition.²¹ He holds that a concern for long-term effects is perfectly compatible with the anthropocentric position. In other words, the preference to protect the environment in the long-term need not be based on the belief that the environment ought to be protected for itself. Consequently, the ‘preservation’ concept becomes free from its apparent synonymy with ‘non-anthropocentric’, and can become a component of Norton’s weak anthropocentrism.²²

Norton points out an important pragmatic benefit. Namely, the goals of preservationists are rendered more palatable to environmental decision makers — who

²⁰ Ibid., p. 217. Norton’s terminology links poorly to the established terminology in community ecology. Norton’s ‘predictability’ is close to the concept of ‘resistance stability’ that is commonly used in contrast to ‘resilience stability’. His term ‘dynamic stability’ has the disadvantage that it invites confusion with the terms ‘dynamically fragile’ vs. ‘dynamically robust’ also used in community ecology for another purpose. See Michael Begon, John Harper and Colin Townsend (eds.), *Ecology: Individuals, Populations and Communities* (Oxford: Blackwell Science Publications, 1986), p. 762.

²¹ Ibid., p. 214.

²² This is well illustrated by Norton’s statement: “My anthropocentrism and Callicott’s nonanthropocentrism ... appear to differ in name only.” Ibid., p. 220, footnote 85.

typically have an anthropocentric viewpoint — if these goals are distanced from the concept of non-anthropocentrism. He also emphasises that congruence of conservationist and preservationist objectives suggests possible terms for consensus at the policy level:

[C1] A consensus regarding a general policy strategy may emerge: we should promote a “patchy” landscape, with as large and as pristine wild areas as possible [= preservation] interspersed among areas of more intense exploitation [= conservation].²³

This consensus, which allows the coexistence of conservation and preservation goals in a single policy framework, is conceptually close to the idea of convergence. Norton, however, introduces the term ‘converge’ in a slightly different context right thereafter:

[C2] I close with a bit of shameless speculation. If Leopold’s argument from ecological holism is sound, if the interests of the human species interpenetrate those of the living Earth, then it follows that anthropocentric and non-anthropocentric policies will converge in the indefinite future.²⁴

This quote is an extension of Norton’s interpretation of Aldo Leopold’s view that “the dichotomy between human values and nonhuman values was a false one: to destroy species and natural systems is to harm humanity.”²⁵

Norton’s interpretation, however, contains two different ideas. One should distinguish the “interpenetration” of the interests of the human species and the living earth from the “convergence” between anthropocentric and non-anthropocentric policies. I shall call the

²³ Ibid., p. 219.

²⁴ Ibid., p. 220.

²⁵ Ibid., p. 206. Aldo Leopold was an American forester and environmentalist who was active during the first half of this century. He proposed the widely quoted ‘Land Ethic’.

former the ‘interpenetration principle’ and the latter the ‘Convergence Hypothesis’ and discuss this distinction in some detail in the next section.

A detailed explanation of both the interpenetration principle and the Convergence Hypothesis follows in Norton’s single-authored book *Toward Unity Among Environmentalists* (page numbers in brackets in the following text refer to this book).²⁶ At the end of the book Norton explicitly uses the term ‘Convergence Hypothesis’ as the culmination of the entire analysis presented in this book. The analysis, according to Norton, is based on a “special philosophical method” (p. 86).²⁷ This method is restricted neither to the formulation of abstract systems of normative reasoning nor to a simple description of the values held by environmentalists. Instead, Norton starts his analysis with *practical examples* and then shows how the objectives that were expressed relate to the abstract level:

We must ... pay attention to the policies environmentalists espouse, try sensitively to relate these policies to the moral principles by which they justify them, *and* examine very carefully the situations in which environmental policy is formulated. (p. 93)

To this end, Norton classifies the values held by environmentalists into at least seven different ‘worldviews’ that provide the source of the moral principles used to justify environmental policies (pp. 197-198, p. 239).²⁸ Some of these worldviews refer to

²⁶ Bryan Norton, *Toward Unity Among Environmentalists* (New York: Oxford University Press, 1991), 287 pp.

²⁷ On p. 90, Norton likens his method to John Rawls’ approach in *A Theory of Justice*.

²⁸ Norton introduces the term ‘worldview’ in contrast to the term ‘paradigm’. The former refers to an explicitly open system while the latter, according to Thomas Kuhn, refers to a closed system (pp. 67 and 93). Norton provides the following names for the seven worldviews: (1) Judaeo-Christian stewardship, (2) Deep ecology and related value systems,

environmental ethical theories such as ecofeminism or deep ecology while others do not. In other words, Norton does not attempt to establish a direct link between the worldviews of environmentalists and the traditional divisions in environmental ethics as an academic field. He evaluates practical examples from four different topics: (1) the pressures of growth, (2) pollution control, (3) biological diversity, and (4) land use policy. Norton's worldview analysis covers most, if not all of contemporary environmentalism and the four environmental issues cover much of the contemporary debate over environmental policy. He can, therefore, claim a certain level of completeness. Norton qualifies his project however by making clear that he is investigating unity among *environmentalists*, and does not claim that environmentalists and non-environmentalists will always agree over environmental policy. An example of a position that he would exclude is the following:

It seems reasonable, however, to argue that an extreme position favoring balancing—one that argues that *all* standard-setting and *all* implementation should be determined by cost-benefit balancing—is not an 'environmentalist' position at all. If pollution efforts might be overridden by a social desire for more air conditioners, for example, environmental goals are given no special status distinct from simple consumer tastes. (p. 133; emphasis in text).

This exclusion of "an extreme position" could be considered a serious constraint on deliberation because, it seems to me, this position may not be all that rare in the policy context. Therefore, Norton's limitation of the scope of the Convergence Hypothesis to "environmentalists" should be kept in mind when discussing its practical applicability.

Norton's historical analysis illustrates that environmentalists, although adhering to different worldviews, have often set aside differences in fundamental values to work towards

(3) Transformationalist/transcendentalism, (4) Constrained economics, (5) Scientific naturalism, (6) Ecofeminism, and (7) Pluralism/pragmatism.

common goals. Norton explains this consensus as a result of both a shared focus on the context of specific situations, and their reliance on ecology (science) to constrain the debate (pp. 191-193).²⁹ Norton clarifies:

[C3] The emerging consensus is unquestionably naturalistic in the broad sense that science informs and constrains decisions about what to do ... Ecology and ecological reasoning set the context for ethical debates. ... The view that ecological understanding will eventually enforce on all discussants a univocal worldview seems to me not entirely implausible, but that strong version of naturalism is unnecessary to support the solid contextual consensus that is emerging among environmentalists.³⁰ (pp. 202-204)

Towards the end of the book, the Convergence Hypothesis is introduced as an accepted belief of environmentalists:

[C4] Although they are fascinated with the disagreement raging over the center, or centers, of environmental values, active environmentalists have made their peace over this issue by accepting an empirical hypothesis — the convergence hypothesis. Environmentalists believe that policies serving the interests of the human species as a whole, and in the long run, will serve also the “interests” of nature, and vice versa. (p. 240)

²⁹ Norton does not address the problem that science (ecology), like ethics, is also in need of convergence. The divergence in ecology is based on opposite atomistic (reductionist) and holistic (integrative) methodological approaches. Buzz Holling calls this divide the “Two Cultures of Ecology”. I have commented on his editorial and argued that the divergence in ecology is neither unique to this discipline nor is it independent from the divergence between ethical atomists (focus on individuals) and holists (focus on ecosystems). See C.S. Holling, “Two Cultures of Ecology,” *Conservation Ecology* 2 (2): 4. [online, URL: <http://www.consecol.org/vol2/iss2/art4>] (1998), and Marc Saner, “Two Cultures: Not Unique to Ecology”. *Conservation Ecology* 3 (1): r2. [online, URL: <http://www.consecol.org/vol3/iss1/resp2>] (1999).

³⁰ ‘Contextualism’ should be understood in contrast to ‘formalism’ (although Norton does not use the latter term). To advocates of the former the primary focus of ethics is the concrete situation while advocates of the latter want to structure morality by a set of abstract principles. After Simon Blackburn, *Oxford Dictionary of Philosophy*, paperback edition (Oxford: University Press, 1994), p. 80.

Norton explains that the Convergence Hypothesis is empirical in nature but “not a precisely formulated hypothesis open to direct test in a series of dramatic experiments” (p. 240). Instead it has a “dual status as (1) a very general empirical hypothesis and (2) an article of environmentalists’ faith” (p. 240). With the second point Norton addresses the faith that apparent conflicts between the well-being of humans and nature will be shown to be unfounded in the future. This expresses what I have called the ‘interpenetration principle’.

Norton illustrates the first point as follows. The Convergence Hypothesis is based on the ecological observation that all things in nature are interrelated. It must, however, be understood at the level of systems, and not applied to individuals. It is obviously false that the interests of a human individual will always converge with the interest of a given *individual* plant or animal. He states: “The domain of the convergence hypothesis, then, is the larger scale within which cultures affect functioning natural systems” (p. 241). As a consequence, the Convergence Hypothesis cannot be falsified by an example of, say, the diverging interests of a hunted animal and a hunter.

One should note that Norton links both components of the dual status of the Convergence Hypothesis to the ‘interpenetration principle’, rather than to the actual observed consensus among environmentalists over policy issues (p. 240-241).

At this point we still lack a precise formulation of the Convergence Hypothesis. Fortunately, such a formulation is found in Norton’s recent response to Brian Steverson on the issue of convergence over endangered species policies.³¹

³¹ Brian Steverson, “Contextualism and Norton’s Convergence Hypothesis,” *Environmental Ethics* 17 (1995): 135-150; and Bryan Norton, “Convergence and Contextualism: Some Clarifications and a Reply

Steverson argues that convergence cannot take place within Norton's overall methodological framework for policy formulation. Steverson's focus is Norton's contextualism and use of the ecosystem health concept. Steverson uses the example of species protection to illustrate how convergence fails. His core argument is based on the following apparent dilemma. On the one hand, contextual management towards environmental health requires the knowledge to engage in a diagnostic, curative, and preventive ecological 'medicine'. On the other hand, such knowledge would allow the resource managers to identify the types of species decline or loss which are ecologically benign. Therefore, (a) either contextual management towards ecosystem health is not feasible due to a *lack* of knowledge, or (b) its application falls short of the policy goals of deep ecologists (radical environmentalists), who want to protect as many species as possible (rather than as many as necessary to maintain ecosystem health), because of an *abundance* of knowledge.

Norton vigorously rejects this critique, on the grounds that the Convergence Hypothesis applies to real-world issues only and not to potential issues in "Steverson's imaginary, probably impossible world".³² In the context of this thesis it is not necessary to dwell further on the Steverson-Norton debate³³ except to note that it triggered Norton to provide a clarification of the Convergence Hypothesis.

to Steverson," *Environmental Ethics* 19 (1997): 87-100.

³² Norton, "Convergence and Contextualism: Some Clarifications and a Reply to Steverson," p. 99.

³³ The latest installment of this dialogue is by Steverson, "On Norton's Reply to Steverson," *Environmental Ethics* 19 (1997): 335-336.

Norton must have felt strongly about the need for such clarification, as he provides no less than four different formulations of the Convergence Hypothesis in his response to Steverson:

[C5] The convergence hypothesis asserts that, if one takes the full range of human values — present and future — into account, one will choose a set of policies that can also be accepted by an advocate of a consistent and reasonable nonanthropocentrism.³⁴

[C6] The convergence hypothesis, which I have offered as an alternative to the traditionally divisive characterization of environmentalists as split between “shallow,” anthropocentric, resource managers and “deep,” non-anthropocentric, environmental radicals, states that *provided anthropocentrists consider the full breadth of human values as they unfold into the indefinite future, and provided nonanthropocentrists endorse a consistent and coherent version of the view that nature has intrinsic value, all sides may be able to endorse a common policy direction* [emphasis in text].³⁵

[C7] The convergence hypothesis is a general, empirical hypothesis *about policy* — it claims that policies designed to protect the biological bequest to future generations will overlap significantly with policies that would follow from a clearly specified and coherent belief that nonhuman nature has intrinsic value [emphasis in text].³⁶

[C8] The convergence hypothesis does not, of course, claim that the interests of humans and interests of other species *never* diverge, but only that they *usually* converge [emphasis in text].³⁷

³⁴ Norton, “Convergence and Contextualism: Some Clarifications and a Reply to Steverson” (Abstract), p. 87.

³⁵ Ibid., p. 87.

³⁶ Ibid., p. 99.

³⁷ Ibid., p. 100.

Despite Norton's clarification the Convergence Hypothesis contains still ambiguities. I shall discuss these in some detail in the next section. The historical development of Norton's convergence project discussed in this section can be summarized as follows.

Norton's convergence project is based on three distinguishable, but nevertheless interrelated, foundations. First, Norton's pragmatic philosophical position makes him very suspicious towards the metaphysical concepts of other philosophers (in particular when they lead to dualisms such as the differentiation between anthropocentric and non-anthropocentric). He expresses this foundation of the convergence project with his argument for weak anthropocentrism and his criticism of the traditional interpretation of preservationism. Norton's theory of weak anthropocentrism is located somewhere on the middle ground between the theoretical positions of environmental radicals and environmental conservatives.

The second foundation of the convergence project is Leopold's belief in the interpenetration of human interests with the 'interests' of natural entities. This article of environmentalist's faith can be used to overcome the dualism between anthropocentrism and non-anthropocentrism. It is, however, not clear to what extent Norton endorses this faith, although he seems to argue that this faith is valid at very large spatial and temporal scales (ecosystems over long times spans). I have called this the 'interpenetration principle'. The interpenetration principle is related to the two other foundations of the convergence project. Weak anthropocentrism expresses the interpenetration principle insofar as it states that the full and long-term consideration of all human interests is sufficient to support efficient preservation policies. The interpenetration principle is related to the Convergence

Hypothesis insofar as it is one of the reasons for the consensus in the policy arena that Norton perceives.

The third foundation of the convergence project is Norton's belief that it is an empirical fact that unity among environmentalists frequently occurs at the level of policy formulation. The problem then is not so much how to create this consensus but rather to explain its existence. Both the belief that this consensus is a general empirical fact, and an attempt at formulating the conditions for how it occurs (the constraints), are expressed in the Convergence Hypothesis. Norton, however, introduces the Convergence Hypothesis with a hint at its theoretical foundation (weak anthropocentrism) when he introduces it in [C6] with "I have offered [it] as an alternative to the traditionally divisive characterization of environmentalists [in the field of environmental ethics] ..."

One should note that Norton presents the Convergence Hypothesis in the context of the actual observable consensus among environmentalists over policy issues in quote [C6]. This is different from the first characterization of the Convergence Hypothesis in *Toward Unity Among Environmentalists* where he introduced it in the context of the interpenetration principle.

Norton underlines the importance of his hypothesis by stressing its political virtue, namely that it may help to overcome the greatest weakness of environmental philosophy: its documented inability to influence environmental decision makers.

If the convergence project is composed of (1) weak anthropocentrism, (2) the interpenetration principle, and (3) the Convergence Hypothesis, then where should a critical analysis begin? Most critics of Norton have focussed on the theoretical foundation of the

convergence project — weak anthropocentrism, contextualism and environmental pragmatism. I use a different approach and focus on the actual Convergence Hypothesis which is, according to Norton, an empirical claim. To some extent I follow Norton's method used in *Toward Unity Among Environmentalists* by analysing the real-world attitudes that environmentalists hold towards biotechnology (at the public and policy levels), and classifying them into worldviews, without making particular references to the underlying environmental ethical positions. Once the issue has been framed the two constraints can be applied and the prospects for convergence can be discussed. This procedure will provide the answer to the question of whether or not the two constraints suffice to resolve the policy debate over biotechnology. This procedure, I believe, provides the strongest criticism: I overlook weaknesses in the theoretical foundation and formulation of the Convergence Hypothesis and show that even a reading in good faith cannot be fully supported because the constraints provided by Norton do not lead to "unity among environmentalists of all stripes" in the case of biotechnology.

A clear understanding of the Convergence Hypothesis demands an analysis of the other foundations of the convergence project, as these foundations are not fully independent of each other. I address this topic in the following section.

Is it a Testable Hypothesis?

The convergence project underwent an astonishing development from its beginning in 1986 as a “shameless speculation” [C2] to Norton’s claim in 1997 that it is an empirical hypothesis that is “supported by facts” [C0]. A more detailed analysis of the interpenetration principle and the actual Convergence Hypothesis sheds light on this apparent contradiction.

The interpenetration principle originates in a view attributed by Norton to Aldo Leopold, namely that the destruction of species and natural systems is ultimately equivalent to harming humanity. This view provides a foundation for the Convergence Hypothesis because, as a result of interpenetration, the long-term interests of both humans and non-humans at the system level should converge. This interpenetration principle is expressed in the following three quotes (restated):

[C2] I close with a bit of shameless speculation. If Leopold’s argument from ecological holism is sound, if the interests of the human species interpenetrate those of the living Earth, then it follows that anthropocentric and non-anthropocentric policies will converge in the indefinite future.

[C4] Although they are fascinated with the disagreement raging over the center, or centers, of environmental values, active environmentalists have made their peace over this issue by accepting an empirical hypothesis — the convergence hypothesis. Environmentalists believe that policies serving the interests of the human species as a whole, and in the long run, will serve also the “interests” of nature, and vice versa.

[C8] The convergence hypothesis does not, of course, claim that the interests of humans and interests of other species *never* diverge, but only that they *usually* converge [emphasis in text].

The interpenetration principle is based on the following simple argument:

- (1) Present and future humans are dependent on a ‘healthy’ natural environment — a flourishing environment is an instrumental value that cannot be spared.
- (2) Members of the environment ‘want’ to flourish and nothing more (if they ‘want’ anything at all).
- (3) Therefore, humankind and members of the environment ultimately have the same goals.

I note that this argument neither results in an empirically testable hypothesis nor is it very compelling. On the one hand, it is trivial to state that *some* human and environmental interests interpenetrate. On the other hand, Norton states himself that it is false that *all* human and environmental interests interpenetrate. The exact degree or magnitude of interpenetration, however, is unknowable. A fundamental problem with the interpenetration principle is that it is not reciprocal. We do indeed (still) depend on our natural environment but the environment does not seem to depend on us. Because we do not know the degree or magnitude of interpenetration we cannot exclude that it is very slim — in which case the conclusion of the interpenetration principle would not be supported.

Understanding the purpose of this argument, however, requires a reading in good faith. When Norton claims that the Convergence Hypothesis is testable then it is not the interpenetration principle that he has in mind. Rather, Norton characterized it as an article of environmentalist’s faith in [C4]. The interpenetration principle provides the rational belief system that environmentalists use to justify the conviction that the preservation of the environment is not a frivolous or quasi-religious quest.

In contrast, the Convergence Hypothesis is testable. It is expressed in the following six quotes (restated in chronological order):

[C1] A consensus regarding a general policy strategy may emerge: we should promote a “patchy” landscape, with as large and as pristine wild areas as possible [= preservation] interspersed among areas of more intense exploitation [= conservation].

[C3] The emerging consensus is unquestionably naturalistic in the broad sense that science informs and constrains decisions about what to do ... Ecology and ecological reasoning set the context for ethical debates. ... The view that ecological understanding will eventually enforce on all discussants a univocal worldview seems to me not entirely implausible, but that strong version of naturalism is unnecessary to support the solid contextual consensus that is emerging among environmentalists.

[C5] The convergence hypothesis asserts that, if one takes the full range of human values — present and future — into account, one will choose a set of policies that can also be accepted by an advocate of a consistent and reasonable nonanthropocentrism.

[C6] The convergence hypothesis, which I have offered as an alternative to the traditionally divisive characterization of environmentalists as split between “shallow,” anthropocentric, resource managers and “deep,” non-anthropocentric, environmental radicals, states that *provided anthropocentrists consider the full breadth of human values as they unfold into the indefinite future, and provided nonanthropocentrists endorse a consistent and coherent version of the view that nature has intrinsic value, all sides may be able to endorse a common policy direction* [emphasis in text].

[C7] The convergence hypothesis is a general, empirical hypothesis *about policy* — it claims that policies designed to protect the biological bequest to future generations will overlap significantly with policies that would follow from a clearly specified and coherent belief that nonhuman nature has intrinsic value [emphasis in text].

[C0] The convergence hypothesis is a contingent truth; a very general empirical hypothesis that shapes solutions sought by adaptive managers in particular situations. It is supported by facts, both directly and indirectly; it could be falsified, but so far it has not been.

Norton provides evidence that the Convergence Hypothesis can be empirically supported in *Toward Unity Among Environmentalists*. The most explicit and complete formulation of the Convergence Hypothesis is given in [C6]. This is the first formulation of the Convergence Hypothesis in which Norton includes explicit constraints on the reasoning of his hypothetical decision-making. I shall analyse it in greater detail since it is this sentence that I attempt to falsify in this thesis. To this end I would restructure [C6] in the following way:

- (1) If 'shallow', anthropocentric, resource managers consider the full breadth of human values as they unfold into the indefinite future and
- (2) if 'deep', non-anthropocentric, environmental radicals endorse a consistent and coherent version of the view that nature has intrinsic value,
- (3) then all sides may be able to endorse a common policy direction.

This empirical claim contains some ambiguity. (1) With respect to the first constraint, anthropocentrists are supposed to consider the "full breadth of human values" but surely this must exclude serious consideration of the metaphysical conceptions that nature has value in itself, in absence of an evaluator. If this conception would not be excluded then the traditional non-anthropocentric positions would be subsumed in an odd way under 'weak anthropocentrism' and the label 'anthropocentrists' would lose its meaning. Further we may wish to ask "Who exactly is going to find consensus?". Norton added commas between "shallow", "anthropocentric", and "resource managers" suggesting the view that he provides a *list* of how environmentalists have been characterized by environmental ethicists. Based on *Toward Unity Among Environmentalists* his intent is clearly to put forth an argument for

consensus among “environmentalists of all stripes”. Norton does not only argue that consensus is possible among environmentalists who agree on all ethical positions except over anthropocentrism vs. non-anthropocentrism. Instead he argues that “all sides”, meaning *any* environmentalist (but not all non-environmentalists) may be able to endorse a common policy direction as long as the constraints specified are adhered to.

(2) With respect to the second constraint, the adoption of a “consistent and coherent view that nature has intrinsic value” can be interpreted in at least two different ways. In the last chapter I distinguish between a narrow and a broad understanding of this constraint. I shall show that this ambiguity is critical as these two different understandings lead to two different tests of the Convergence Hypothesis and two different conclusions result.

(3) What is meant by “may be able”? From the context it is clear that the Convergence Hypothesis has *not* been formulated in response to somebody claiming, “Under no circumstances will the different sides ever endorse a common policy direction”. Since it is commonly known that debates over policy are sometimes resolved, hardly anybody would make such a claim. The expression ‘may be able’, then, does not express ‘will sometimes’ but rather (a) ‘will more often than commonly expected’, or (b) ‘will mostly’, or (c) ‘will usually’. When Norton uses the word ‘usually’ in [C8], it is applied to the interpenetration principle. In [C7] Norton uses the expression ‘significant overlap between policies’ but this expression does not express a frequency. Consequently, it is difficult to interpret ‘may be able’. From the context of *Toward Unity Among Environmentalists* it is likely that Norton intends to make the ambitious claim that convergence will *usually* take place provided the constraints are being followed. Otherwise, the Convergence Hypothesis would have far less

practical importance than Norton obviously thinks it has. I assume this meaning for the purpose of this thesis.³⁸ I do not, however, test the Convergence Hypothesis against a single well-chosen case but rather evaluate it in the light of a broad controversy. I frame this controversy as the divergence between so-called consequentialist and non-consequentialist ethical positions (defined below). To my knowledge Norton never addressed the potential tension between these two positions.

Another, less severe ambiguity lies in the expression “policy direction”. Does this (a) restrict the Convergence Hypothesis to agreement over environmental protection *goals* or (b) does it include agreement over the *means* required to achieve these goals. Again, from the context of *Toward Unity Among Environmentalists* it is plausible that Norton has the more ambitious second option in mind and applies the Convergence Hypothesis to all environmental policies. A critique of the clarity of the Convergence Hypothesis, however, is not the main strategy I want to pursue in this thesis. Instead, I want to read the Convergence Hypothesis in good faith, based on the understanding of the spirit of the convergence project outlined in this chapter, and treat it as a testable hypothesis.

In order to more fully appreciate the importance of the Convergence Hypothesis it is now necessary to locate it within the broader field of environmental ethics. To this end I question how Norton’s convergence strategy differs from other approaches proposed in the field of environmental ethics and also locate Norton’s weak anthropocentrism within the historical development of the field.

³⁸ I note that a truly testable empirical hypothesis would have to be quantitative rather than qualitative. Example: “If A and B then C with probability P”.

Is the Label 'Convergence' Justifiable?

I want to briefly discuss the Convergence Hypothesis in terms of the six alternatives I introduced above:

<i>Theoretical Level:</i>	Conquest	Reconciliation	Toleration
<i>Practical Level:</i>	Selection	Convergence	Accumulation

A vertical comparison leads to James Sterba's reconciliation theory.³⁹ Sterba contrasts his theory with Norton's Convergence Hypothesis in that he (Sterba) not only seeks convergence at the policy level but at the theoretical level as well.⁴⁰ Sterba defines three universal principles: a principle of human defence, a principle of human preservation, and a principle of disproportionality.⁴¹ The third principle of disproportionality is crucial:

Actions that meet nonbasic luxury needs of humans are prohibited when they aggress against the basic needs of animals and plants.⁴²

³⁹ James Sterba, "Reconciling Anthropocentric and Nonanthropocentric Environmental Ethics," *Environmental Values* 3 (1994): 229-244. Also: J. Sterba, "Reconciling Anthropocentric and Nonanthropocentric Environmental Ethics," in *Earth Ethics — Environmental Ethics, Animal Rights, and Practical Applications*, ed. J. Sterba (Englewood Cliffs, New Jersey: Prentice Hall, 1995), pp. 199-213.

⁴⁰ Ibid., p. 241, endnote 3.

⁴¹ He recently added a fourth principle of rectification. He presented this idea at the workshop *The Ethics of Human Health and Ecosystem Health: Toward an Inclusive Understanding*, McMaster University, 2-4 October 1998.

⁴² Sterba, *Earth Ethics*, p. 202

Sterba claims that these three principles together strike the proper balance between concerns for human welfare and the welfare of nonhuman nature. He admits, however, that the adoption of the principle of disproportionality would significantly change the way we live.⁴³

Consequently, Sterba's reconciliation project can be considered to be more politically ambitious relative to Norton's convergence claim, at least from a policy perspective. One could also argue, however, that the Convergence Hypothesis is more ambitious in the sense that Norton seems to claim that a problem which has kept environmental philosophers busy for the last 30 years 'simply disappears' if only minimal constraints are put in place and if one focuses on the empirical level.

The two approaches are clearly different in that Sterba proposes a new theory whereas Norton wants to avoid commitments to any such theories. I conclude that the Convergence Hypothesis is well demarcated from Sterba's reconciliation theory.⁴⁴

The 'horizontal comparison' leads to less clearly defined demarcations. It is certain that Norton opposes what I have called the "conquest" and "selection" strategies. He is, for example, fundamentally opposed to Callicott's proposition that a single theory serves as the basis of environmental protection. Norton argues that such a monistic approach to theory-

⁴³ Ibid., p. 202.

⁴⁴ Norton, Steverson, and Sterba do not cite additional convergence or reconciliation theories in environmental ethics. Other authors, however, have pointed out that a focus on the apparent opposition between anthropocentrism and non-anthropocentrism is non-productive. For example, Laura Westra states: "I believe that the anthropocentric/non-anthropocentric distinction presents a false dichotomy in several senses, and that it is no more than a red herring, advanced by those concerned with defending the present status quo." p. 283 in Laura Westra, "Why Norton's Approach is Insufficient for Environmental Ethics," *Environmental Ethics* 19 (1997): 279-297.

building is counter-productive as it separates environmental philosophers from real environmental management issues.⁴⁵ Norton obviously believes that his weak anthropocentrism is *not* a monistic environmental ethical theory. To this end, Norton attempts to show that most of the goals of environmentalists can be accommodated within weak anthropocentrism. Arguably, however, not everybody would agree that weak anthropocentrism provides a truly pluralistic basis for the convergence of preferences of “environmentalists of all stripes”. I address this topic below when I place the Convergence Hypothesis in its historical context within environmental ethics.

Norton explicitly supports moral pluralism and what I have called the “toleration” and “accumulation” strategies.⁴⁶ The convergence project, in fact, requires accepting the viability of pluralistic ethics at the theoretical level (Norton’s ‘worldviews’). Convergence, to Norton, is a description of how moral pluralism works at the policy level. The theory of moral pluralism in environmental ethics was first introduced by Christopher Stone.⁴⁷ I shall only briefly illustrate how Stone’s views compare to Norton’s Convergence Hypothesis Stone states:

⁴⁵ Bryan Norton, “Why I am Not a Nonanthropocentrist: Callicott and the Failure of Monistic Inheritism,” *Environmental Ethics* 16 (1995): 341-358.

It is noteworthy that despite the sharp disagreement between Norton and Callicott they both base much of their work on Aldo Leopold’s land ethic.

⁴⁶ Bryan Norton, “Integration or Reduction: Two Approaches to Environmental Values,” in *Environmental Pragmatism*, eds. Andrew Light and Eric Katz (London: Routledge, 1996), pp. 105-138.

⁴⁷ Christopher Stone, *Earth and Other Ethics: The Case for Moral Pluralism* (New York: Harper & Row, 1987).

Stone, Christopher, “Moral Pluralism and the Course of Environmental Ethics,” *Environmental Ethics* 10 (1988): 139-154.

... what I call Moral Pluralism ... invites us to conceive of moral activities as partitioned into several distinct frameworks, each governed by distinct principles and logical texture.⁴⁸

Moral pluralism is distinct from relativism in that it does not express the view that all morals are context-dependent. Instead, it allows the “reference to several distinct frameworks, each appropriate to its own domain of entities and/or moral activities.”⁴⁹ This view is illuminated by Andrew Brennan’s discussion of two different kinds of moral pluralism.⁵⁰ The first kind, Stone’s moral pluralism, “recognizes the possibility that *different considerations apply in different cases*”.⁵¹ The second kind, Brennan’s moral pluralism, “maintains that there is no single theoretical lens which provides a privileged set of concepts, principles and structure in terms of which a situation is to be viewed.”⁵² Thus, within Stone’s moral pluralism one moral view can be selected as the most applicable to a given situation. In contrast, within Brennan’s “radical moral pluralism” different moral views are applied to any given situation.

Norton’s pluralism is closer to Brennan’s version of moral pluralism. The distinct feature of Norton’s pluralism is the claim that the diverging worldviews of environmentalists converge at the policy level insofar that they call for the same policies in a given context.

⁴⁸ Stone, *Earth and Other Ethics*, p. 13.

⁴⁹ Stone, “Moral Pluralism and the Course of Environmental Ethics,” Endnote 5.

⁵⁰ Andrew Brennan, “Moral Pluralism and the Environment,” *Environmental Values* 1 (1992): 15-33.

⁵¹ *Ibid.*, p. 28 (emphasis in text).

⁵² *Ibid.*, p. 29.

This brief set of comparisons should suffice to locate Norton's Convergence Hypothesis within the six strategies for achieving greater coherence in environmental ethics or greater consensus in environmental policy that I differentiate in this thesis.

What can be said about the position of weak anthropocentrism and the idea of convergence within the historical development of environmental ethics? I address this question with a brief chronological overview of the foundations of environmental ethics. The dialogue over the foundations of environmental ethics entered mainstream philosophy with Holmes Rolston's seminal paper "Is There An Environmental Ethic?" in *Ethics*.⁵³ Holmes Rolston makes a distinction between "secondarily" and "primarily ecological ethics". The former refers to traditional ethics enriched by the explicit consideration for the environment. The latter refers to a true environmental ethic. In later writings Holmes Rolston defends a primarily ecological ethics based on the assumption of the intrinsic value of nature (his position is a variation of biocentric ethics). Therefore, although Holmes Rolston does not use these terms in his early paper in *Ethics*, the difference between the secondarily and primarily environmental ethic is that the former anthropocentric ethic is based on the instrumental valuation of the environment while the latter non-anthropocentric is based on the intrinsic valuation of the environment. It is noteworthy that Holmes Rolston's already anticipated the possibility for convergence in the following way:

⁵³ Holmes Rolston III, "Is There an Ecological Ethic?" *Ethics* 85 (1975): 93-109.

Perhaps the cash value is the same whether our ethic is ecological in secondary or primary senses; yet in the latter I find appeal enough that it has my vote to be so if it can. To the one, man may be driven while he still fears the world that surrounds him. To the other, he can only be drawn in love.⁵⁴ [Emphasis added]

In another seminal paper, Baird Callicott discusses shortcomings of theories of animal liberation and argues that an environmental ethic must be based on the consideration of the ecosystem level.⁵⁵ Callicott supports the idea that ecosystems have intrinsic value⁵⁶ and distinguishes between three types of ethics: traditional, extensionist animal liberation, and true environmental ethics as represented by the land ethic. At this stage we are faced with two different dimensions upon which an environmental ethic could be based: anthropocentrism vs. non-anthropocentrism and individuals vs. ecosystems.

Bryan Norton moves to fill what looks like a gap caused by Callicott's dual emphasis on the system and non-anthropocentrism. The three tables below illustrate what I mean by the word "gap". They are designed to illustrate the progression of how the basis of environmental ethics has been defined by Holmes Rolston, Callicott, and Norton. Like Callicott, Norton advocates Leopold's land ethic. Norton argues, however, that the land ethic can be interpreted in two different ways. The terms "Land ethic A and B" in the table below represent the distinction of the two 'modes' that Norton distinguishes in Leopold's ethic and activism (Norton does not use the labels "A" and "B") as indicated in this quote:

⁵⁴ Ibid., p. 109.

⁵⁵ J. Baird Callicott, "Animal liberation: A triangular affair," *Environmental Ethics* 2 (1980): 311-338.

⁵⁶ More precisely, Callicott supports the idea of 'value for itself' (inherent) rather than 'value in itself' (intrinsic).

He [Leopold] spoke favorably of P.D. Ouspensky's organicism, suggesting that it differs from the modern, scientific view of a functioning biosphere only "in language". But he abandoned nonanthropocentrism as a philosophy to support environmental policy, because "to most men of affairs, this reason is too intangible to either accept or reject as a guide to human conduct." For pragmatic reasons, therefore, Leopold resolved to enter debates on environmental policy as an anthropocentrist ...⁵⁷

Thus, in the policy arena, Leopold would have chosen to express himself in the terminology of Norton's weak anthropocentrism rather than Callicott's non-anthropocentrism (according to Norton). To Norton, Leopold's reasoning is a justification for the rejection of the idea of intrinsic (or inherent) value in nature.

Holmes Rolston III (1975): "Is there an ecological ethic?" (and later publications)	<i>Moral Considerability</i>	
	<i>Anthropocentric</i> (instrumental valuation of the environment)	<i>Non-Anthropocentric</i> (intrinsic valuation of the environment)
<i>Type of Theory</i>	Traditional ethics (secondarily ecological).	Environmental ethics (primarily ecological).

Baird Callicott (1980): "Animal liberation: A triangular affair"		<i>Moral Considerability</i>	
		<i>Anthropocentric</i>	<i>Non-Anthropocentric</i>
<i>Moral Considerability</i>	<i>Individuals</i>	Traditional ethics.	Animal liberation.
	<i>Ecosystems</i>		Environmental ethics = Land ethic.

Bryan Norton (1984): "Environmental ethics and weak anthropocentrism" (and later publications)		<i>Moral Considerability</i>	
		<i>Anthropocentric</i>	<i>Non-Anthropocentric</i>
<i>Unit of Observation</i> or <i>Moral Considerability</i>	<i>Individuals</i>	Traditional ethics (strong anthropocentrism).	Animal welfare; Biocentric ethics.
	<i>Ecosystems</i>	Environmental ethics = • Weak anthropocentrism; • Land ethic A (see text).	Land ethic B (see text); Deep ecology.

⁵⁷ Norton, "Conservation and Preservation : A Conceptual Rehabilitation.", p. 206.

The point I wish to make here is that one would be justified in considering Norton's new addition of weak anthropocentrism to represent, in reality, a step backwards in the history of environmental ethics, as it is conceptually close to Holmes Rolston's 'secondarily ecological ethic'. Nevertheless, Norton can claim originality with his justifications for weak anthropocentrism and the connection he makes to the practical level with the Convergence Hypothesis.

In this chapter I have illustrated the meaning of the Convergence Hypothesis and located the convergence project within the field of environmental ethics. The test conducted in the last chapter of this thesis will result in further characterizing the boundaries within which the Convergence Hypothesis can be applied. First, however, I shall present the test case that I am going to use.

THE TEST CASE: BIOTECHNOLOGY GIVES RISE TO DIVERGING ENVIRONMENTAL ETHICS AND POLICY PROBLEMS

Like any other human activity affecting the environment, the environmental release of biotechnological products gives rise to environmental ethical issues. The use of biotechnology, however, more than any other human activity has the power to fundamentally change our relationship with the environment. It enables us, in principle, to replace our natural environment with an engineered quasi-natural environment. It also enables us, in principle, to replace ourselves with individuals who are better adapted to thrive in the environment that we have been creating. This appears to entail unique and important environmental ethical issues. For example, one can question if the creation of new life forms is compatible with an attitude of respect for sentient creatures, for other organisms, or for all of nature. Or, one can question from both traditional and environmental ethics viewpoints if it is desirable and permissible to stop the aging of humans. Or, one can question the (ethical) permissibility of the patenting of living organisms. Biotechnology is one of the first technologies where not only the resulting effects, but also the preceding scientific investigations are an ethical issue.

Further, the high environmental persistence of many (but not all) biotechnological products make them very difficult to control should they cause undesired effects. Therefore, a careful evaluation of such products prior to their environmental release is particularly important — much more so than in the case of chemical products which are typically less persistent (because they do not reproduce). The stakes are high because of the massive potential of biotechnology to benefit or harm.

In this chapter I show that the diverging attitudes environmentalists hold towards biotechnology, and the resulting contemporary policy issues, provide a good case to test Norton's Convergence Hypothesis against. I describe the issues surrounding biotechnology in some breadth because I shall argue that the Convergence Hypothesis applies to some but not to other issues. Norton's characterization of the Convergence Hypothesis makes it necessary to look at the larger issues rather than select a single isolated case. Further, biotechnology has the potential to affect every aspect of our lives and, therefore, generalizations about this technology and its effects must be based on an understanding of its broad scope.

In a first step I provide a definition and clarification of the technical scope of biotechnology. I show that the technical classification of biotechnology is not independent of the ethical issues. More precisely, the fundamental rejection of biotechnology goes hand-in-hand with defining biotechnology as a novel method. In contrast, the promotion of biotechnology goes hand-in-hand with defining biotechnology as a more efficient way of pursuing traditional methods of manipulating the environment. In a second step, I discuss how different environmental ethical theories disagree with respect to the use of biotechnology. This theoretical perspective, however, is an insufficient basis for the test of Norton's Convergence Hypothesis because Norton proposes "unity among environmentalists" and not "unity among environmental philosophers". Consequently, in a third step, I illustrate the public manifestation of environmental ethical issues regarding biotechnology in some detail. I discuss in separate sections popular literature, environmental activism, and biotech policy and show to what extent a divergence among environmentalists is apparent. In combination

with the theoretical overview this demonstrates that biotechnology constitutes an appropriate test case for Norton's Convergence Hypothesis. During the course of this analysis I argue that the core disagreement is best captured by differentiating between 'non-consequentialist' and 'consequentialist' attitudes (defined below).

Defining 'Biotechnology'

The scope of 'biotechnology' is controversial. On the one hand, popular dictionaries link the term 'biotechnology' with modern biology as follows. Webster's 10th New Collegiate Dictionary states two definitions: "biotechnology (1941) — 1: applied biological science (as bioengineering or recombinant DNA technology) — 2: ergonomics." The term 'biotech' is synonymous with 'biotechnology' but was introduced to the English language more recently in 1974 according to Webster's.⁵⁸ Similarly, the 9th edition of the Concise Oxford Dictionary of Current English states: "biotechnology — the exploitation of biological processes for industrial and other purposes, esp. genetic manipulation of micro-organisms (for the production of antibiotics, hormones, etc.)."⁵⁹

On the other hand, in public debate it is often said that biotechnology is thousands of years old because all of agriculture can be considered an exploitation of biological processes.

⁵⁸ Merriam-Webster Inc., *Webster's Tenth New Collegiate Dictionary* (Springfield, Mass.: Merriam-Webster Inc., 1994).

⁵⁹ Della Thompson (ed.), *The Concise Oxford Dictionary of Current English*, Ninth Edition (Oxford: Clarendon Press, 1995).

This conflict is well illustrated by the following quote taken from a recent talk by an expert on risk communication. William Leiss states:

“Genetic Engineering” or “Biotechnology”? Sometimes these two terms are used interchangeably. Sometimes GenEng is called “new biotechnology,” versus “traditional” biotechnology, which refers to very familiar practices such as selective breeding of farm animals or the creation of new varieties of vegetables and flowers. This is very misleading usage and should be abandoned: Calling these familiar practices “biotechnology” — a term coined in 1947 to describe ergonomics, and not applied to biological research until 1970 — is an example of “retrospective definition.” This misleading usage has the odour of manipulation about it: It can seem to be an apparently clever maneuver by promoters of genetic engineering to “keep the rubes in the dark” and stop awkward questions from being asked.⁶⁰

I accept Leiss’ view and shall use the term ‘*biotechnology*’ (and occasionally the synonym ‘*biotech*’) to represent only the modern techniques based on recombinant-DNA.⁶¹ In contrast, I shall use the term ‘*breeds*’ for the outcome of traditional modifications based on outcrossing and selection. By differentiating between biotechnology and breeds I can leave open the question of whether the difference between the two is potentially morally significant.⁶² I want to highlight, however, that the question of the precise difference between biotechnology and traditional techniques is difficult and important. A clear description of this difference is

⁶⁰ William Leiss, “Genetic Engineering, a Risk Communication Challenge,” *PowerPoint Handout from the Symposium for the Official Opening of the Biosciences Complex* (Queen’s University, 28 November 1997), slide 14.

⁶¹ The recombinant-DNA technique is the foundation of genetic engineering and was developed in the early 1970s. It is based on the use of restriction enzymes that make the cutting of DNA at specific locations possible.

⁶² I will show later that the choice of *distinguishing* between ‘biotechnology’ and ‘breeds’ is ethically significant: this distinction contains already the idea that biotechnology may give rise to unique ethical issues — this is by no means clear if biotechnology is understood as a simple extension of traditional practices.

required to examine whether biotechnology gives rise to issues which are unique in the environmental ethical context. I discuss this problem later in this chapter.

A further term is needed for organisms which have been used in agriculture, aquaculture, forestry, landscaping, gardening, or environmental restoration, but which are not genetically modified by human intervention. I shall call these '*natural biologicals*' (as opposed to chemicals).

It is also very important not to restrict the answer to "What is biotechnology?" to a simple abstract definition. Without a concrete understanding of its actual and potential scope, the diverse processes and products comprised by biotechnology, one is tempted to provide an ethical debate over a few contemporary issues — for example the release of herbicide-resistant transgenic plants — and then imply that *all* of the environmental use of biotechnology is intrinsically questionable or defensible.⁶³ This is problematic because policy decisions on subsidies, regulations, moratoria, and the like, have very broad effects on all of biotechnology. The point is: without a systematic, detailed and concrete treatment of *all* of environmental biotechnology it is not possible to understand what is at stake.

The classification of biotechnological releases can be done in two fundamentally different ways. I stated above that I restrict use of 'biotechnology' to products that are based

⁶³ Prominent environmental ethicists have only rarely commented on biotechnology. An exception is a recent article by Laura Westra, "Biotechnology and Transgenics in Agriculture and Aquaculture: The Perspective from Ecosystem Integrity," *Environmental Values* 7 (1998): 79-96. Westra justifiably criticizes the ethical claims made by some proponents of biotechnology, discusses some recent problematic cases of the use of biotechnology, and then concludes that a cautious approach is needed. She does not discuss the *potential* environmental benefits from the use of biotechnology and, therefore, it would be incorrect to generalize from her analysis to the conclusion that all of biotechnology is highly problematic.

on the use of recombinant-DNA, i.e., based on a specific *method*. This focus on method can be extended to the classification of all biological ‘products’.⁶⁴

This approach leads to an apparently clear difference between natural biologicals, breeds, and biotech products. Further, this classification clearly reveals the extent to which sentient animals have been used to create a biotech product and ‘how natural’ the transformation is — the methods of biotechnology (genetic engineering) can be differentiated according to criteria that are relevant in an ethics context. **Table 1** (in the Appendix) illustrates such a classification of products for environmental use based on different kinds and magnitudes of genetic changes. Only a small number of methods need to be differentiated in the context of environmental ethics. I call this conception of biotechnology the ‘*process-based conception of biotechnology*’.

A problem with this approach, however, is that the properties of the process which generate a product for environmental release are poor indicators of its potential impact (societal, human health, or environmental). This problem is addressed by the classification of biotech products based on potential *effects*.

It is tempting to base this classification on the current most important biological products and group them according to their intended uses. Considering the rapid development of biotechnology however, it is more desirable to create a classification system which encompasses any conceivable biological agent. This classification would include agents that are presently not technically possible or economically viable. This conceptual approach could

⁶⁴ I use ‘product’ in the broad sense which is not restricted to biotech agents that are packaged and marketed.

be designed based on the following matrix: the world is divided into (1) microorganisms, (2) plants, (3) animals, and (4) the abiotic environment and components of the manipulation of the environment can be classified as (1) system, (2) target, and (3) agent — producing a 4×3 matrix. The resulting combinations should encompass all major groups of theoretical and existing biological products for environmental use.⁶⁵ No differentiation between natural biologicals, breeds, and biotech products needs to be made.

Of particular interest may be the categories without ‘target’ where some of the agents are themselves the reason for the environmental release. Here biotechnology can result in the greatest change in terms of intended effect. For example, biotechnology may lead to greater shelf-life of vegetables, to lower fat content of meat, even to the expression of completely novel traits never before expressed in nature. In the other categories biotechnology is a means to improve the efficacy of biologicals and to achieve goals which are difficult to reach with natural biologicals — no fundamental shift in intended effect takes place. Therefore, this classification of biotechnology emphasizes the similarities between traditional agricultural methods and the use of genetically engineered organisms.

Table 2 (in the Appendix) illustrates such a classification of products for environmental use based on their intended effect. Almost fifty different types of living

⁶⁵ Products with multiple intended effects and abiotic agents are not listed. Further, non-deliberate or accidental releases of biotechnological products are not covered. By non-deliberate release I mean, for example, the environmental release of genetically engineered microorganisms after human consumption of milk products containing living specimens of these organisms or the outcrossing of transgenic plants with wild relatives. By accidental release I mean, for example, the escape of genetically engineered organisms designed for laboratory use.

products can be differentiated. This number is much increased when dead biological agents and chemical extracts are also considered to represent ‘biologicals’. I call this conception of biotechnology the *‘purpose-based conception of biotechnology’*.

I have now shown that the question “What is biotechnology?” can be answered in two diverging ways — by emphasizing or de-emphasizing differences between genetic engineering and the traditional use of biologicals. Later in this chapter I refer back to **Tables 1 and 2** and show how these perspectives relate to diverging positions regarding biotechnology. Before describing the diverging positions actually held within environmentalism and environmental policy, I am going to describe the theoretical level. The following summary of theories of environmental ethics, and their positions towards biotechnology, provides the theoretical foundation for much of the public debate.

Divergence at the Theoretical Level — Environmental Ethics

Does the deliberate release of genetically engineered organisms give rise to ethical issues within environmental philosophy? Because different theories of environmental ethics have different general conceptions of what is beneficial and what is harmful to human interactions with the environment, they may reach different judgments about the benefits and harms of biotechnology in particular. In order to survey these differences quickly yet systematically, I will classify theories of environmental ethics in terms of their conception of

the good. By 'the good' I mean to denote the supposed final end at which action must aim.⁶⁶ I do not take a position on the priority of 'the good' to 'the right'. Instead, I shall formulate the conceptions of the good in a broad sense, describing the goals of the different ethical theories as they relate to biotechnology. This allows for the evaluation of the attitudes that advocates of different environmental ethics would have vis-a-vis biotechnology.

A survey of environmental ethics reveals a bewildering array of conceptions of the good. Some types of environmental ethics overlap with traditional ethics while others require the adoption of a fundamental shift in beliefs. There are at least five to ten clearly distinct types of environmental ethics. Their classification is not always straightforward since many elements of their fundamental platforms are shared. Nevertheless it is possible to discuss the different environmental ethical theories that are distinguished in most textbooks, note the conception of the good, and the implications regarding biotechnology. I should point out, however, that I usually cannot draw on literature references indicating how major interpreters of the different theories judge biotechnology. There is a curious void in the literature. The leading journal in the field, *Environmental Ethics*, for example, has not published a single article dedicated to the topic of biotechnology in the twenty years since its inception. Therefore, I offer my own interpretation of what the different theories imply.

Within the majority of environmental ethical theories biotechnology has the potential to be harmful *or* beneficial (e.g., it could be considered harmful *not to use* biotechnology). This is quite obvious for the *anthropocentric position*. The anthropocentric position is

⁶⁶ Based on the entry on 'good' in Simon Blackburn, *Oxford Dictionary of Philosophy*, paperback edition (Oxford: University Press, 1996), p. 160.

characterized by a restriction of moral considerability to humankind. All non-human entities, in this view, have instrumental value only meaning that they derive their value from a human valuator. The good is the well-being of humans — this may or may not include unborn and future generations. Biotechnology has the potential to be harmful if its application leads to health, environmental, or socio-political problems. The decision *not* to use biotechnology could lead to harm because of the loss of the potential to reduce illness, hunger, or poverty. Within the anthropocentric position, knowledge and technology may be considered valuable in their own right and one could even imagine the use of biotechnology as an art form.

Anthropocentric environmental ethics may be divided into non-consequentialist (deontological) and consequentialist (teleological) ethics. I introduce these terms here for later use in conjunction with the ethical theories and ethical concerns listed below. Robert G. Olson provides a good definition of an early meaning of these expressions:⁶⁷

A deontological theory of ethics is one which holds that at least some acts are morally obligatory regardless of their consequences for human weal or woe. The popular motto “Let justice be done though the heavens may fall” conveys the spirit that most often underlies deontological theories.

The common feature of all teleological theories of ethics is the subordination of the concept of duty, right conduct, or moral obligation to the concept of the good or the humanly desirable.

One should note that the meaning of these terms has shifted historically. James Griffin notes:

The term was coined by Elizabeth Anscombe in her article “Modern Moral Philosophy” [note: published in 1958], but her use differed from the now current one. For her, consequentialism is the view that consequences have some moral weight in any act, non-consequentialism the view that some acts are right or wrong whatever the consequences. For instance, murder, one might say, is

⁶⁷ Robert Olson, “Deontological Ethics” and “Teleological Ethics,” entries in *The Encyclopaedia of Philosophy*, ed. Paul Edwards (New York: Macmillan, 1967).

absolutely prohibited; it is wrong no matter what good might come (whereas nonconsequentialists, on the now current view, merely hold, say, that murder is wrong independently of its consequences, though if a sufficient amount of good would come it might not be prohibited).⁶⁸

All other environmental ethical theories are non-anthropocentric — the well-being of non-humans is being considered in moral deliberations. The extension of anthropocentrism to include some animals leads to (consequentialist) utilitarian arguments for *animal liberation* and the (non-consequentialist) deontological *animal rights* view. The former application of utilitarianism is spearheaded by Peter Singer.⁶⁹ The good is the minimization of pain and suffering for the greatest number of sentient beings. Biotechnology has the capacity to interfere with, or foster the maximization of this good. One target of Peter Singer's is the so-called factory farm where animals presently can experience great pain. It is conceivable, for example, that the pain of these animals could be reduced by means of the genetic engineering of farm animals.

The deontological approach to animal welfare is spearheaded by Tom Regan.⁷⁰ Regan argues in support of granting moral standing to higher animals that could be considered "subjects-of-a-life" — animals that are complex enough to be called conscious of their own

⁶⁸ James Griffin, "Consequentialism", entry in *The Oxford Companion to Philosophy*, ed. Ted Honderich (Oxford: University Press, 1995), p. 154.

⁶⁹ Peter Singer, *Animal Liberation: A New Ethics for Our Treatment of Animals* (New York: Avon Books, 1977).

Note: Singer's ideas on both utilitarianism and the sentience criterion go back to the British 18th century philosopher Jeremy Bentham.

⁷⁰ Tom Regan, *The Case for Animal Rights* (Berkeley: University of California Press, 1983).

“psychophysical identity over time”.⁷¹ Such animals are considered by Regan to possess inherent value. Regan argues that we have a duty to respect and not to harm these animals. This duty is equivalent to our duty not to harm innocent humans. The good then is the fulfilment of this duty and the well-being of the subjects-of-a-life. Some forms of biotechnology could be supported based on this theory. For example, the genetic modification of food plants could be considered a duty if this activity would most certainly lead to the reduced harm of subjects-of-a-life (includes humans). Respect for “higher animals” and avoidance of “speciesism”, however, may lead to the categorical rejection of *some* types of modern biotechnology (for example when mammals or birds are subject to genetic engineering). As in the field of biomedical ethics, the dignity of donors and recipients of genetic materials is an important concern within the theory of animal rights.

Advocates of *biocentric ethics* argue for the inherent worth of all life. This theory has its roots in Albert Schweitzer’s “reverence for life” principle. A complete development of this theory was first proposed by Paul Taylor.⁷² Taylor proposes a system of four beliefs⁷³ and

⁷¹ Regan provides a long list of characteristics that could be used to identify subjects-of-a-life. Many of these characteristics, however, would be difficult to verify in a given animal. It is clear from the context that Regan believes that, for example, farm animals are subjects-of-a-life.

⁷² Paul Taylor, *Respect for Nature: A Theory of Environmental Ethics* (Princeton, NJ: University Press, 1986).

A number of authors argue now for variations of this ethical theory. For a recent defence of biocentric ethics see James Sterba, “A Biocentrist Strikes Back,” *Environmental Ethics* 20 (1998): 361-376.

⁷³ These are (1) humans are part of and dependent on nature, (2) the biosphere is a complex and interconnected web, (3) there are many different points of view from other teleological centres of life, (4) denial of human superiority. Simplified from *Respect for Nature*, pp. 99-100.

claims that the adoption of these beliefs leads to an “ultimate moral attitude” that he calls “respect for nature”. Taylor develops these four general duties that follow the adoption of respect for nature: nonmaleficence, noninterference, fidelity, and restitutive justice.⁷⁴ The good could be expressed as the fulfilment of these duties and the freedom of all living entities to pursue their individual telos (i.e., goals, perfection). Because of its clearly specified duties Taylor’s theory is deontological but it also contains the need to adopt a moral attitude that characterizes it as an ethic of character (virtue). In either case it can be called non-consequentialist. Taylor also proposes these five principles to adjudicate among conflicting claims: self-defence, proportionality, minimum wrong, distributive justice, and restitutive justice.⁷⁵ It is permissible, for example, for humans to kill other life in self-defence or to satisfy *basic* interests (the latter based on the principle of proportionality)⁷⁶. Arguably, biotechnology is a component of the pursuit of human telos. It is difficult, however, to show that most of the currently proposed environmental biotechnological products represents a vital need for humans. This would be a requirement to justify our interference with the telos of other living entities that is the very nature of biotechnology.

The following environmental ethical theories are non-anthropocentric *and* concern themselves with the (holistic) level of ecosystems rather than the (atomistic) level of individuals. A key figure in North American environmentalism, Aldo Leopold formulated

⁷⁴ Taylor, *Respect for Nature*, pp. 169-192.

⁷⁵ Taylor, *Respect for Nature*, pp. 263 and following.

⁷⁶ See also Sterba’s principle of disproportionality discussed in the previous chapter.

a holistic ethic that he named the *land ethic*.⁷⁷ Without any sophisticated philosophical justification he specified the good as “the integrity, stability and beauty of the Land”.⁷⁸ The land ethic has been further developed by philosophers, most notably by Baird Callicott⁷⁹ but the principle maxim has remained intact — a maxim that is clearly consequentialist in character. Biotechnology could further this good when it is used as a tool for environmental clean-up or when more efficient land use leads to the protection of more wilderness. Biotechnology could be harmful when it is out-of-control, or used to intensify traditional exploitation of the land.

Deep ecology does not refer to one systematic philosophy but rather a bundle of ideas contained in radical environmentalism. The term was coined by Arne Naess⁸⁰ and the concept has been further developed, for example, by Bill Devall and George Sessions⁸¹, and Warwick

⁷⁷ Aldo Leopold, *A Sand County Almanac* (New York: Ballantine Books, 1966), originally published in 1949.

⁷⁸ Leopold, *A Sand County Almanac*, p. 262.

⁷⁹ J. Baird Callicott, *In Defense of the Land Ethic: Essays in Environmental Philosophy* (Albany: State University of New York Press, 1989). Note: Bryan Norton derives much of his inspiration from Leopold but disagrees with Callicott on key points. In particular, Callicott portrays the land ethic as a paradigm non-anthropocentric ethic while Norton judges it compatible with weak anthropocentrism. Norton’s view is unorthodox, however, and most environmental philosophers would consider the land ethic far removed from any traditional use of the concept ‘anthropocentric’.

⁸⁰ Arne Naess, “The Shallow and the Deep, Long-Range Ecology Movement,” *Inquiry* 16 (1973): 95-100.

⁸¹ Bill Devall and George Sessions, *Deep Ecology: Living as if Nature Mattered*, (Layton, UT: Peregrine Smith Books, 1985), pp. 65-73.

Fox.⁸² Fox actually criticises the label “deep ecology”. Nevertheless, theories commonly labelled “deep ecology” have in common that they are all fundamentally anti high technology, although some “appropriate technology and non-dominating science” is permissible.⁸³ Like biocentric ethics, deep ecology is based on the idea of “biocentric equality”— all beings are equally members of an interrelated whole and have an equal right to develop. It is difficult to reconcile this view on equality with the fundamental transformation of nature. Biocentric equality is one of two “ultimate norms” of deep ecology. The other norm is called “self-realization” and expresses the view that there is no clear dichotomy between self and object. If I understand correctly then the good could be best described as the awoken “ecological consciousness” that is based on self-realization and biocentric equality.⁸⁴ Any modern (“dominating”) technology, including biotechnology, is an obstacle on this spiritual path. Because deep ecology is founded on strict fundamental attitudes and beliefs regarding the environment it is close to a non-consequentialist environmental ethical theory. It is not clear, however, to what extent consequentialist elements are important as well.

The following social theories cannot be easily classified within the consequentialist vs. non-consequentialist scheme. Like deep ecology, *ecofeminism* is perhaps too diverse to

⁸² Warwick Fox, *Toward a Transpersonal Ecology: Developing New Foundations for Environmentalism* (Boston, Mass.: Shambhala, 1990).

⁸³ Devall and Sessions, *Deep Ecology: Living as if Nature Mattered*, Figure 1.

⁸⁴ As mentioned above, deep ecology is not a single theory. Further, deep ecologists rely on a variety of strategies to communicate their worldview. They include “reliance on poetry, Buddhism, spiritualism, and political activism, including acts of civil disobedience and ecosabotage” (based on Joseph Desjardins, *Environmental Ethics*, p. 202). Consequently, it is difficult to distill the essence of deep ecology into one notion of the good.

be represented by a single conception of the good.⁸⁵ Ecofeminists see a close causal relationship between the domination of women and nature. At the risk of oversimplification I would surmise that some potential consequences of biotechnology, for example the simultaneous improvement of both the condition of nature and the situation of women could be considered a good from the viewpoint of ecofeminism. Some biotechnological processes and products may be compatible with an ethic of care especially if compared to the technology they could replace. This 'good' would be considered of little value, however, if it co-occurs with the maintenance or reinforcement of the traditional culture of patriarchic domination.⁸⁶ A different issue, the potential commodification of human reproduction may be discussed with terminology from non-consequentialist ethics by ecofeminists.

Social ecology bears similarities to ecofeminism.⁸⁷ The main good in social ecology is social justice (including the absence of social domination) — environmental protection can be seen as an ingredient and by-product of social justice. Like in ecofeminism, the domination of people and the domination of nature are considered interlinked in social ecology. Biotechnology clearly is a paradigm case for the domination of nature. Further, biotechnology could enforce social domination if it becomes monopolized by the dominant

⁸⁵ Karen Warren (ed.), *Ecological Feminism* (London: Routledge, 1994).

⁸⁶ It is noteworthy that one of the leading biotechnology critics, Vandana Shiva, is an ecofeminist. Main books on the topic: Vandana Shiva, *Monocultures of the Mind: Perspectives on Biodiversity and Biotechnology* (London: Zed Books Ltd., 1993) and V. Shiva (ed.), *Biopolitics: A Feminist and Ecological Reader on Biotechnology* (London: Zed Books Ltd., 1995). V. Shiva, *Biopiracy: The Plunder of Nations and Knowledge* (Boston, Mass.: South End Press, 1997).

⁸⁷ Murray Bookchin, *The Philosophy of Social Ecology: Essays on Dialectical Naturalism*, 2nd Edition (Montréal: Black Rose Books, 1996).

class. In theory, biotechnology could be a tool in creating a just society but social problems should be addressed first and this is easier if the technological development is retarded (rather than accelerated as is the case with biotechnology). This sceptical attitude towards biotechnology is based on consequentialist reasoning.

This brief survey over the main theories in environmental ethics reveals that diverging conclusions regarding the permissibility of biotechnology emerge. Consequentialist theories such as *animal liberation* or the *land ethic* cannot support a fundamental approval or rejection of some or all of biotechnology — a case-specific evaluation would be required. Non-consequentialist theories that emphasize our duties towards other organisms (*animal rights* or *biocentric ethics*) or that emphasize attitudes of respect or attitudes against domination (sometimes this includes an anti-technology attitude) can support the fundamental rejection of some or all of biotechnology.

In this section, I chose to frame the debate by emphasizing the divergence between ‘consequentialist’ and ‘non-consequentialist’ ethics because this distinction seems to best describe the divergence between a focus on ends (environmental protection) vs. means (the choice of a technology). In contrast, the divergence between anthropocentric and non-anthropocentric ethics does not provide so clearly divided positions on the ethical issues raised by biotechnology. As mentioned in the introduction to this chapter, Norton would not be moved by an apparently strict divergence at the theoretical level as his Convergence Hypothesis applies to the policy level. It is now necessary to investigate whether or not this divergence at the theoretical level is realized in the public world.

Divergence at the Empirical Level — 1. Literature Present and Past

Do diverging attitudes in environmental philosophy manifest themselves in literature, environmental activism and policy? A manifestation of diverging attitudes in popular literature may be the least important of these three ways of describing the empirical state. It allows me, however, to go back further into the past relative to the descriptions of contemporary environmental activism and policy. This has the utility of addressing one possible objection that Norton may raise. He could argue that no unsurmountable divergence within environmentalism existed until environmental philosophers confused the issue through the choice of diverging terminologies. In other words, a serious divergence which is manifest now could be an artefact of the influence of (diverging) environmental philosophers on the (originally less divergent) environmentalists.

In this section I first quote a small number of contemporary popular books to illustrate the existence of fundamental non-consequentialist concerns. This could be contrasted with the consequentialist attitude found in the arguments of other critics of biotechnology that are concerned with, for example, what they consider insufficiently developed risk assessments. It could also be contrasted with the consequentialist attitude of advocates of biotechnology who emphasize its potential benefits. I do not, however, document these consequentialist positions as they do not require proof of their existence. In a second step I trace back diverging attitudes towards *all* of technology to the ancient Promethean myth.

Non-consequentialist concerns are apparent in the writings of the following three authors. Robert Sinsheimer puts it this way: “What happens to the reverence for life when

life is our creation, our plaything?”⁸⁸ Bill McKibben states: “we could limit ourselves voluntarily, *choose* to remain God’s creatures instead of making ourselves gods ... Of course we can splice genes. But can we *not* splice genes?”⁸⁹ (emphasis in text). Jeremy Rifkin recently wrote: “The biotech revolution will affect every aspect of our lives ... The Biotech age will force each of us to put a mirror to our most deeply held values, making us ponder the ultimate question of the purpose and meaning of existence. This may turn out to be its most important contribution”.⁹⁰

What are the roots of the attitudes manifest in these texts? Arguably, public concern over biotechnology started well before recombinant-DNA methods were developed. A case in point is Mary Shelley’s novel *Frankenstein*.⁹¹ Concerns similar to the ones raised by Shelley with her description of the attitude of Dr. Frankenstein, and the resulting suffering of the monster and its environment, are still being expressed. Bernard Rollin, in his book *The Frankenstein Syndrome* states:

⁸⁸ Robert Sinsheimer, “Genetic Engineering: Life as a Plaything?” in *Contemporary Moral Controversies in Technology*, ed. A.P. Iannone (New York: Oxford University Press, 1987), pp. 128-131. Quote on p. 130. Originally published in *Technology Review*, April 1983.

⁸⁹ Bill McKibben, *The End of Nature* (New York: Anchor Books, 1990), pp. 214-215.

⁹⁰ Jeremy Rifkin, *The Biotech Century: Harnessing the Gene and Remaking the World* (New York: J.P. Tarcher / Putnam, 1998), pp. 236-237.

⁹¹ Mary Shelley, *Frankenstein, or The Modern Prometheus* (World’s Classic Paperback Edition, Oxford: University Press, 1980). Originally published in 1818 and 1831.

Was it possible that the Frankenstein story was, in some sense, an archetypal myth, metaphor, or category that expresses deep concerns that trouble the modern mind? Could the “Frankenstein thing” provide a Rosetta stone for deciphering ethical and social concerns relevant to genetic engineering of life forms? ⁹²

The complete title of Mary Shelley’s novel is *Frankenstein, or The Modern Prometheus*. Rollin neither quotes this full title nor lists the novel in his references to *The Frankenstein Syndrome*. This is perhaps the reason why Rollin does not discuss the Greek myth of Prometheus. The examination of this myth is worthwhile. It provides an insight not only into *Frankenstein* but also into the attitudes of ancient Greek civilization towards technology.

Mary Shelley’s reference to Prometheus is not spurious. She developed the idea for *Frankenstein* when she and her husband Percy Shelley visited Lord Byron in 1816.⁹³ In that year Byron wrote a poem entitled *Prometheus*. Percy Shelley began his most important poetic achievement *Prometheus Unbound* in 1818, the year *Frankenstein* was first published. In short, the myth was familiar and important to the trio of Lord Byron - Mary Shelley - Percy Shelley.⁹⁴

⁹² Bernard E. Rollin, *The Frankenstein Syndrome: Ethical and Social Issues in the Genetic Engineering of Animals* (Cambridge: At the University Press, 1995), p. 2.

Note also that critics of transgenic foods use the term “Frankenstein Foods” and the multinational biotechnology corporation *Monsanto* has been dubbed “The Frankenstein Corporation” in the journal *The Ecologist* 28/5 (Sept./Oct. 1998): 306.

⁹³ According to Mary Shelley’s introduction to the 1831 edition of “Frankenstein” (the first edition was anonymous).

⁹⁴ M.K. Joseph, “Introduction” to Mary Shelley, *Frankenstein, or The Modern Prometheus* (World’s Classic Paperback Edition, Oxford: University Press, 1980).

According to the earliest tradition Prometheus was the maker of all humans.⁹⁵ More commonly known is the myth related by Hesiod ⁹⁶ in which Prometheus is a Titan who steals fire from the chief god Zeus in order to protect humankind. As retaliation for this act Zeus sends Pandora with a jar containing all evils to Prometheus' brother who marries her. Pandora then opens the jar ('Pandora's Box') and all evils immediately flow over the earth. Aeschylus developed this myth in the play *Prometheus Bound* and made Prometheus not only the provider of fire and civilization but also the provider of the arts and sciences as the means of survival.⁹⁷ Prometheus himself is tortured by Zeus who has him chained and exposed to an eagle who continuously eats his immortal liver. The following quote illustrates that Prometheus conserves his rebellious attitude despite Zeus' terrible punishment. The cost of attempting to reach god-status is explicit in Hermes' response:

(Prometheus in chains; out of the blue: Hermes appears)

Prometheus: Look now, here's Zeus's errand boy, special assistant to the new Dictator. No doubt he's come to hand out some news.

Hermes: You there! Yes, you ... are, I presume, the bitter, too bitter, intellectual who committed crimes against the Gods, who gave their glory away to things that live and die, the one who stole our fire!

....

⁹⁵ Dora and Erwin Panofsky, *Pandora's Box: The Changing Aspects of a Mythical Symbol* (New York: Bollingen Foundation and Pantheon Books, 1956), p. 7.

⁹⁶ Flourished approximately 700 B.C.

⁹⁷ This summary combined from articles in *Britannica CD 98 Standard Edition* (Chicago, IL: Encyclopaedia Britannica Inc., 1994-1998).

Hermes to the Chorus: Remember what I proclaim to you: when doom hunts you down don't blame your luck, don't say Zeus hurled you down to unforeseen pain. Not so. For you'll have brought this on yourselves. There will be no surprise either, no tricks: for you'll be tangled up with the boundless net of disaster, and through your own madness.⁹⁸

Before I elaborate on the connections that I perceive among biotechnology, *Frankenstein*, and Prometheus I want to point out that a single quote cannot possibly represent the essential message of the group of texts that represent the Promethean myth. I have already noted that Aeschylus' interpretation is not equivalent to the original myth. Further, Aeschylus wrote a trilogy of which only the first part — *Prometheus Bound* — is known in detail. From what is known about the rest, it appears that the conflict between Prometheus and Zeus becomes resolved in the last part of the trilogy. Finally, Plato retold the Promethean myth in *Protagoras* that represents yet another influential version of this myth. Consequently, it is difficult to summarize exactly what the Promethean myth meant, and means, in our cultural heritage.

Nevertheless, the following general comments seem to be well supported. There are two important differences between *Frankenstein* and *Prometheus Bound* in terms of their relationship with the contemporary debate over biotechnology. First, *Frankenstein* is not typically read or cited within the context of the Promethean myth. Instead, to most readers it represents a romantic gothic novel, a work of 'science-fiction', something purely imaginary. This gives it little credibility on its own even if it continues to strike strong emotional cords. In contrast, the ancient Promethean myth is a classic of our cultural heritage that expresses

⁹⁸ Aeschylus, *Prometheus Bound* (New York: Oxford University Press, transl. James Scully and C.J. Herington, 1975), pp. 76, 82. Originally written approximately 450 B.C.

a fundamental dilemma caused by our technological abilities. As such it has a clout and credibility that cannot be matched by *Frankenstein*. It may be no coincidence that the academics who are sympathetic with concerns over biotechnology tend to compare the biotechnology controversy with Prometheus while academics who are critical of these concerns would establish a link to *Frankenstein* (e.g., Rollin).

The second difference lies in the complexity of the outcome. Dr. Frankenstein's actions have only negative consequences. After a brief period of discovery, the monster starts to suffer, then society suffers, and finally the creator is killed by his 'invention' while he (the creator) attempts to undo his wrong. In contrast, Prometheus has a special gift that Dr. Frankenstein seems to lack — the gift of foresight (as expressed by the name 'Prometheus'). Having foresight, it is not necessarily unwise to challenge the supreme god (Zeus). Accordingly, the classical wrong of stealing fire does not lead only to undesirable consequences. The benefits of having technology are enormous but Zeus' revenge is powerful and affects both the bearer of the 'gift' (Prometheus) and the receivers (humankind).

Where does the Promethean myth stand with respect to consequentialist vs. non-consequentialist attitudes? Prometheus could be called the ultimate consequentialist agent. Having foresight, it is possible for him to defeat even the supreme god Zeus. On the other hand, the catastrophic outcome makes the reader ponder the wisdom of this bold stance. The myth leaves room for justification of a non-consequentialist attitude of respect for the divine (or natural) order — the hesitation to commit hubris. Hermes statement to the chorus is clear: you are warned not to defeat the gods.

I conclude that the Promethean myth is more applicable to the dialogue over biotechnology when compared to the Frankenstein novel. In the case of biotechnology we have some foresight but we are unsure about how well we are presently forecasting the risks due to a lack of experience with this new technology. We are defeating “god” or “nature” in that we are (once again) crossing a boundary that has been previously considered untouchable. The potential benefits are enormous and so are the potential risks. As a consequence, we are unsure if we should repeat Prometheus’ gamble or if we should accept a more humble attitude — for example by adopting the traditional religious view that god (nature) is not a ‘dictator’ but, instead, the provider of an order that must not be disturbed.

In summary, selected contemporary literary examples reveal the existence of a critical and rigid attitude towards biotechnology on non-consequentialist grounds. A divergence between critical and optimistic attitudes over new technologies and over the ‘crossing of natural borders’ can be traced back to the works of the ancient Greeks.

Divergence at the Empirical Level — 2. Environmental Activism

The test of the Convergence Hypothesis requires a real-world policy example. Debates over policy, however, earn their justification from the public debates. In this section I want to outline the concerns of radical environmentalists and contrast them with the attitudes of conservative environmentalists. At the end of this section I shall provide a short list of the main issues given rise by biotechnology (in the environmental context).

The literary examples cited at the beginning of the previous section testify that criticism of biotechnology may be expressed in a rigid, non-consequentialist language. Similar criticism can be found within environmental activism (although much of the concern over biotechnology is also risk-based). The United States Secretary of Agriculture stated in July 1997 that biotechnology is “shaping up to be the first battle royale of the 21st century world agriculture”.⁹⁹ The biotech debate is particularly heated in Europe. For example, “A wave of protest in recent weeks against genetically modified crops in Britain seems to have taken scientists, industrial managers and politicians alike by surprise”.¹⁰⁰ This surprise must be rooted in a complete lack of empathy with non-consequentialist thinking because only weeks before this wave of protest the crown prince of Britain wrote in London’s Daily Telegraph “I happen to believe that this kind of genetic modification takes mankind into realms that belong to God and to God alone.”¹⁰¹ The existence of non-consequentialist (and consequentialist) concerns is also apparent in the result of the empirical assessment of objections regarding genetic engineering conducted by L.J. Frewer and co-workers.¹⁰²

⁹⁹ Anonymous, “Biotech: First 21st Century Battle Royale,” *EnviroLink Network* (<http://www.envirolink.org>, 18 July 1997).

¹⁰⁰ Editor of the Journal *Nature*, “‘Gene-foods’: the alternative to a moratorium,” *Nature* 394, issue 6694 (13 August 1998): 605.

¹⁰¹ Helen Branswell, “Prince Charles heats up debate over genetically altered crops,” *The Ottawa Citizen* (9 June 1998): on-line edition.

¹⁰² L.J. Frewer, D. Hedderley, C. Howard, & R. Shepherd, “‘Objection’ mapping in determining group and individual concerns regarding genetic engineering,” *Agriculture and Human Values* 14 (1997): 67-79.

A good way to start an analysis of the ideological positions regarding biotechnology is to characterize the extremes. If one combines an anthropocentric point of view with a technology-friendly attitude, one would endorse biotechnology as a way to fix the problems that we previously created. At the very extreme, one can imagine advocates who would *not only want to fix our environment, but humankind as well*, and thus break free from genetic determinism as far it exists. This attitude would be guided by an assessment of consequences. In contrast, if one combines an non-anthropocentric point of view with an anti-technological attitude, one would reject biotechnology as yet another form of disrespectful and unwise interference with the non-human world. At the very extreme, one can imagine advocates who would *reject all forms of agriculture and biotechnology as 'biological pollution'*.¹⁰³ This attitude may be motivated by the belief that 'technology will ultimately bring bad consequences. Because of its rigid character, however, it is better characterized as a non-consequentialist attitude of respect for nature and belief in duties towards nature.

David Pepper provides an excellent review of contemporary environmentalism.¹⁰⁴ According to Pepper it is extremely difficult to make typologies of environmentalists. This statement justifies scepticism towards any such typology, including Norton's worldviews and the following description. Although there may be an array of possibilities of how to classify

¹⁰³ For a description of the potential scope of 'biological pollution' or 'bioinvasion' see Chris Bright's *Life Out of Bounds: Bioinvasion in a Borderless World* (New York: W.W. Norton & Company, 1998). Jeremy Rifkin in *The Biotech Century* uses the term 'genetic pollution'. Neither of these two authors, however, apply this terminology to agriculture, nor do they imply that the criticism of biotechnology leads to "a rejection of agriculture".

¹⁰⁴ David Pepper, *Modern Environmentalism: An Introduction* (London: Routledge, 1996). The comment on typologies is on p. 34.

the views of environmentalists regarding biotechnology, the extremes that I have just characterized would fit into the traditional differentiation of environmentalists into reformist 'technocentric' and radical 'ecocentric' camps.¹⁰⁵ The former are represented by 'cornucopians' (named after the horn of plenty; extremely technocentric) and environmental managers (moderately technocentric), while the latter are represented by 'self-reliant soft technologists' (moderately ecocentric) and deep ecologists (extremely ecocentric). Pepper states:

The ecocentric position on technology is complex. It is not anti-technology, though it is 'Luddite', given that the Luddites did not protest against technology of itself but against its ownership and control by an élite. Ecocentrism advocates 'alternative', that is, 'soft', 'intermediate' and 'appropriate', technologies partly because they are considered environmentally benign, but also because they are potentially 'democratic'. That is, unlike high technology they can be owned, understood, maintained and used by individuals and groups with little economic or political power.¹⁰⁶

On the surface, the divergence thus portrayed seems only to express that one endorses or rejects biotechnology based on one's ideological stance towards high technology. One can, however, characterize these positions more completely by emphasizing different conceptions of nature. Pepper distinguishes beliefs concerning the ability of nature to recover. Advocates of what has been called (by other authors)¹⁰⁷ the '*myth of nature benign*' believe that the ability of nature to recover is underestimated by environmentalists. Advocates of the '*myth*

¹⁰⁵ This is classification that was first proposed by T. O'Riordan, *Environmentalism* (London: Pion, 1981).

¹⁰⁶ David Pepper, *Modern Environmentalism*, p. 38.

¹⁰⁷ Pepper cites M. Schwarz and M. Thompson, *Divided we Stand: Redefining Politics, Technology and Social Choice* (London: Harvester Wheatsheaf, 1990).

of nature ephemeral’ claim the opposite, namely that the ability of nature to recover is being overestimated by resource managers. Further, Pepper distinguishes between beliefs about ‘the nature of nature’. Nature can be viewed as a place of hard work and harshness or, more romantically, as a place of peace and harmony. I argue that biotechnology can be most clearly endorsed based on the view that nature is a place where ‘dog-eats-dog’ and which quickly recovers when stressed. In contrast the view that nature is ‘peaceful and harmonious’ but also fragile will result in a sceptical or hostile attitude towards biotechnology.¹⁰⁸ The question of whether ‘nature’ (in both senses — including or excluding humans) ought to be ‘improved’ or whether it is ‘perfect only without our interference’ is a metaphysical and metaethical problem for which no answer is within reach.¹⁰⁹

How do these diverging positions relate to the question “What is biotechnology?” The justification of categorical (non-consequentialist) objections against biotech would be based on the process-based conception of biotechnology (**Table 1**, Appendix) because it is suggestive of biotechnology’s uniqueness. In contrast, the purpose-based conception of biotechnology (**Table 2**, Appendix) is suggestive of the view that biotechnology is not at all unique and does not deserve to be fundamentally rejected. This conception of biotechnology is, therefore, the basis for a non-categorical (consequentialist) attitude towards biotechnology.

¹⁰⁸ Note the relationship to Rolston’s division of primarily and secondarily ecological ethics being motivated by love or by fear, respectively.

¹⁰⁹ In at least one sense a convergence may take place between these two worldviews. Namely, both conceptions of nature can lead to a desire for *distancing*. On the one hand, if nature is considered hostile then one wants to keep it away because of the dangers it may pose. On the other hand, if nature is considered fragile and harmonious then one wants to isolate it in order to protect it from destruction.

One may question the coherence of the extreme position that I characterized as ‘rejecting all forms of agriculture and biotechnology as biological pollution’. Biotechnology poses a peculiar problem in a debate over what is ‘pollution’ or what is ‘natural’.¹¹⁰ The problem can be exemplified by the statement of Mike Gale, one of Britain’s leading researchers in the field of transgenic organisms for agricultural use: “What could be more organic than DNA?”¹¹¹ The central dilemma for the critics of biotechnology is the existence of a slippery slope between traditional ways of dealing with the environment and biotechnology. If it is permissible to use some traditional chemicals and breeds in organic agriculture then why not use biotechnology? Without a fundamental difference between breeds and biotech products it seems incoherent to advocate a fundamental rejection of some or all of biotechnology.

This echoes the position of advocates of biotechnology who consider all of agriculture to be ‘biotechnology’. To make their positions more clear I present the following two examples that advocates of biotechnology could put forth.

(1) Radical environmentalists argue that traditional breeds of crops are more ‘natural’ than biotech products. This does not need to be the case. A patent has recently been granted

¹¹⁰ The differentiation between the natural and the artificial is very complex. See, for example, Jacques Monod, *Chance and Necessity* (New York, Alfred Knopf Inc., transl. from French by Austyn Wainhouse, 1971), pp. 3-22.

¹¹¹ In an interview with Reuters. Anonymous, “Interview — Gene Crop Potential Immense — Researcher,” *Reuters Environmental News* (<http://www.planetark.org>, 9 March 1999).

for a chemical ingredient in the surface wax of wild tomatoes.¹¹² This ingredient has insect-repellent properties but it is no longer produced by modern breeds of tomatoes. By means of biotechnology one could fix this defect and make the tomatoes more ‘natural’ again.¹¹³

(2) Radical environmentalists argue that the dignity of a sentient creature is violated when animals are being ‘improved’ by means of biotechnology. The same environmentalists, however, do not seem to mind that pets are being ‘fixed’ in this society to avoid inconveniences for their owners. Would it not be more natural (and humane) to have fixes of this kind built-in into the ‘natural’ make-up of our companion animals? Further, environmentalists do not take a strong stance against the keeping of dogs although most breeds are extreme deviations from the wild type (note the impressive potential of biotechnology) — why then oppose a single ‘surgical’ genetic alteration?

There is no doubt that radical environmentalist *do* take a fundamental stance against biotechnology. Warwick Fox states “[To recommend genetic engineering as a result of the norm ‘evolution’ is to] recommend human interference in the biology of all organisms to a degree and on a scale that exceeds most environmentalists’ worst nightmares”.¹¹⁴ Is the position of radical environmentalists consistent?

¹¹² Anonymous, “Tomatoes’ Natural Pest Repellent Patented,” *EnviroLink Network* (<http://www.envirolink.org>, 7 November 1997).

¹¹³ A similar example is the use of biological control of weeds and pests: an exotic invasive organism is controlled by supplementing natural enemies obtained from the place of origin of the invader in order to ‘fix’ the ecosystem that is being invaded. This can be done by using natural biologicals, breeds, or biotechnological ‘products’.

¹¹⁴ Fox, *Toward a Transpersonal Ecology*, p. 194.

The pet examples pose no real problem for environmental radicals: they are against the keeping of dogs and cats, although they would not oppose friendship with a naturally living wild animal. It is more difficult to take a radical stance against all of agriculture. In the following I want to defend the position of radical opponents of biotechnology by arguing that (a) they are able to criticize *all* of agriculture, including traditional and 'organic' agriculture, in a rational fashion and (b) that the fundamental rejection of biotechnology is not incompatible with the attitude of moderation towards agricultural technology.

Larry Gonick and Alice Outwater's popular *Cartoon Guide to the Environment* provides some fragments of the basis from which environmentalists may reject all of agriculture:¹¹⁵

Before exploring the expansion of the humans species, consider this paradox: After the invention of agriculture, most people were *worse off* than their ancestors. From skeletons we know that when agriculture arrived, average height declined about 4 inches [...] Compared to hunter-gatherers, farmers work harder, eat less nutritious diet, and get sick more often. [p. 100]

The first great civilization, the Sumerian, arose in the rich soil between the Tigris and Euphrates rivers [...] At first, Sumerian farmers simply abandoned salty plots and plowed elsewhere [...] After more than 2000 *successful* years of fertility, Sumer's soil became almost useless. Crops yields plunged and by 1700 B.C., population had fallen by a factor of 10, to around 150,000. The land never recovered. It is now the scrubby desert of southern Iraq. [p. 94-95]

In the 1960s and 1970s, agricultural scientists tried to address the problem of world hunger by creating the *Green Revolution*. [...] Many poor countries embraced the Green Revolution ... and then market forces took over. It turned out there was a downside to the new, revolutionary greens: they needed a lot of fertilizer and water [...] Result: More industrial agriculture, more food, and more poverty! [pp. 166-167]

¹¹⁵ Larry Gonick and Alice Outwater, *The Cartoon Guide to the Environment* (New York: Harper Perennial, 1996).

These quotes present a truly devastating account of agriculture from its origin to the present time. If these quotes are taken as facts then one indeed must wonder (a) if we ought to attempt to dramatically reduce our population and live a simple life style and (b) if one should trust the expectations raised by a 'second green revolution'. Based on this view it becomes possible to understand why the radical environmentalists' group Earth First! uses the slogan "Back to the Pleistocene!" Note also that scientists presently discuss the extent to which human society resembles a 'cancer' in all sincerity.¹¹⁶ I believe this illustrates how an anti-modernity attitude is being defended.

The problem for radical environmentalists is not so much the justification for the desire for a non-technological world. The problem is of practical nature — it seems implausible to turn the wheel of time backwards. The solution then is the search for the *limit* and the adoption of the virtue of *moderation*. Moderation is not only a traditional virtue but is also suggested by our experience with how biological systems work. For example, if we live in moderation the homeostasis of our personal physiology is maintained, even if we do not always treat our bodies with perfect consistency — *some* excesses are forgiven. In analogy, one may believe that if our acts towards the environment are guided by the attitude of moderation then its functions, for example within a farm system, will be maintained.¹¹⁷

¹¹⁶ For example at the meeting of the American Anthropological Society (Philadelphia, December 1998). Summarized by Malcolm W. Browne, "Will Humans Overwhelm the Earth? The Debate Goes On," *The New York Times* (December 8, 1998), online edition.

¹¹⁷ Note that most ecologists do not apply the concept of 'homeostasis' to ecosystems.

Not all new technologies are rejected but novel inventions, especially those that resemble previous problem cases often are. Such evaluation is dominated by an attitude of scepticism towards new technologies because it is easier to resist new technology than revert to the past. Further, environmentalists believe that the 'end of nature' is approaching in the sense that everything on earth is becoming an artefact.¹¹⁸ Nature without artefacts has become scarce because chemical (and noise) pollution are virtually everywhere. Biotechnology, however, is a prime target in this context. If we make artefacts out of organisms 'from within' we do something that an environmentalist could argue is more profound (and longer lasting). To a radical environmentalist, biotechnology may easily be the worst possible offender against the ideals of moderation and minimal interference. By means of biotechnology humankind can interfere with nature not only from the 'outside' but the also from 'within', not only slowly but very quickly, not only locally but globally, not only short-term but forever.¹¹⁹

Therefore, an environmentalist, holding the conception of agriculture just described, can reject environmental biotechnology in a fundamental way and simultaneously tolerate the continuation of a more-or-less traditional agriculture without being inconsistent.¹²⁰

¹¹⁸ McKibben, *The End of Nature*.

¹¹⁹ The biotech industry faces the following public relations dilemma. On the one hand it needs to emphasize the *revolutionary* potential of biotechnology in order to attract funding. On the other hand it needs to emphasize that biotech products are *nothing new* in terms of the risks they pose (or in terms of the ethical issues they raise) in order to avoid new regulatory barriers.

¹²⁰ To radical environmentalists this may seem an unnecessarily complex way to put the issue. They may simply feel a quasi-aesthetic (and quasi-religious) revulsion against biotechnology, a very clear gut-feeling that renders a reasoned argument obsolete.

So far I have provided only a very general description of the ethical issues given rise by biotechnology. In conclusion of this section I provide a list of reasons in favour of prohibiting some or all implementations or uses of biotechnology. I present these reasons classified as consequentialist or non-consequentialist viewpoints.

Consequentialist reasons for limiting biotechnology:

(a) *Higher risk.* The possibility exists that some or all uses of recombinant-DNA have an intrinsically higher (or lower) risk relative to the use of traditional techniques. This risk could take at least three forms: undesired health, environmental, or social effects. For example, the widespread use of marker genes for antibiotic resistance across many types of biotech products could speed up the development of resistance of pathogens to antibiotics. Biotechnology may also carry inherent risks to the stability and integrity of the land. Finally, the monopolization of food sources within a country, or internationally, and the exploitation of genetic resources ('bioprospecting' or 'biopiracy') could pose a risk to social and global justice.

(b) *High rate and magnitude of change.* The rate and magnitude of change is much increased through the use of biotechnology. This increased change takes place at different scales. The use of biotechnology leads to faster results relative to traditional breeding. A larger number of new products will result as it is cheaper relative to breeding. Further, greater phenotypic modifications and, thus, greater deviation from the wildtype will be achievable. This increased rate of change provides novel opportunities; it allows us to dream up novel goals that were previously out-of-reach (e.g., glow-in-the-dark plants to replace night

lights).¹²¹ Some of these novel goals are based on novel intentions and these entail novel ethical issues. Further, a multitude of intended effects can be ‘packaged’ into a single ‘product’. Any organism may be a resource of DNA and, therefore, the exploitation of genetic resources is at a global scale in the case of biotechnology. Finally, biotechnology provides enhanced potential for biological warfare (including race-specific weapons) but it can also be used for the development of defensive weapons.

(c) *Problem of detection.* The minuscule amount of DNA typically transferred in biotechnology, its precision, is an important advantage relative to traditional breeding. It also carries, however, the potential for what one could call ‘deception’. Traditional breeding is based on such massive genetic exchange that the phenotypes who carry specific traits usually look distinct. For example, a “Golden Delicious” apple looks different than a “McIntosh”. Biotechnology makes it possible to build traits into organisms which are completely undetectable without biotechnological tools. Here we are faced with a rate of change which is unexpectedly low.

Non-consequentialist reasons for prohibiting biotechnology

(a) *Ownership and patenting.* The patenting of genes or entire organism is an ethical issue that is unique to biotechnology (these concerns are also being debated in biomedical ethics).

¹²¹ See for example, William Bains, “Biotechnology for pleasure and profit,” *Biotechnology* 11 (1993): 1243-1247.

(b) *Dignity*. The dignity of the donor and recipient of the genetic material is an issue for advocates of animal rights (again these concerns overlap with topics of biomedical ethics).¹²²

(c) *'Naturalness'*. The transgression of the "species-barrier" may influence how "natural" a procedure is. The exchange of genetic materials between species of so-called higher plants and animals is impossible or extremely rare in nature and cannot be achieved through breeding. Some types of breeding are 'artificial' in the sense that it is *unlikely* that they may happen in nature (e.g., the cross between an African and an North-American ornamental plant; the selection for sterile crops). Some applications of biotechnology, however, are artificial in the sense that it is *impossible* that they would happen in nature (e.g, the insertion of a particular gene from a fish into a tomato). From a religious viewpoint the question of 'are we playing god' may be posed when it comes to the creation of organisms which would not likely have been created by the biological evolution on earth in the near future. From the viewpoint of radical environmentalism the use of biotechnology may well be worst offender in our progression from (permissible) non-dominating close-to-nature technology to (unwise) high technology.

It is noteworthy that critics of biotechnology provide their (non-consequentialist) rigid rejection of biotechnology side-by-side with (consequentialist) concerns over risk. I quoted

¹²² For example, the hypothetical creation of a non-sentient headless pig, to be used as an organ donor, would be an environmental ethics issue that could be addressed by analogy with the (complex) debate over the scarcity and procurement of organs.

Prince Charles at the beginning of this section. His letter article in the Daily Telegraph was reprinted in a recent edition of *The Ecologist*. Here is a more complete quote:

I happen to believe that this kind of genetic modification takes mankind into realms that belong to God and to God alone. ... We simply do not know the long-term consequences for human health and the wider environment of releasing plants bred this way.¹²³

The “Latin American Declaration on Transgenic Organisms” prepared by over fifty organisations for the Biosafety Protocol Meeting in Colombia, February 1999:

1. We reject genetic engineering because it is an ethically questionable technology which violates the integrity of human life, of species which have inhabited our planet for millions of years and of ecosystems. ...
5. Science is incapable of predicting the risks and impacts — affecting biodiversity, human and animal health, the environment as well as production systems — which the deliberate release of transgenic organisms may produce.¹²⁴

It is not evident why a categorical rejection on ethical grounds needs to be accompanied by a contingent rejection on scientific grounds. I am going to address this issue further in the last chapter of this thesis.

In this section I have shown that the debate over biotechnology cannot simply be framed as a divergence between ‘anthropocentrists’ and ‘non-anthropocentrists’.¹²⁵ Instead, I have framed the principal divergence among environmentalists as occurring between

¹²³ HRH the Prince of Wales, “Seeds of Disaster”, *The Ecologist* 28/5 (1998): p. 252.

¹²⁴ Latin American peasant, indigenous, environmental, and other civil society sector organizations, “Latin American Declaration on Transgenic Organisms,” posted on the *Biodiversity Convention Listserver* (biodiv-conv@igc.org, 18 February 1999).

¹²⁵ One still could argue, however, that a clear distinction between the ‘psychology of knowledge’ and the ‘logic of knowledge’ (epistemology) would reveal the overriding importance of the anthropocentric / non-anthropocentric distinction at the logical level. Terminology from Karl Popper, *The Logic of Scientific Discovery* (New York: Basic Books, Inc., transl. by author, 1959), p. 30. Originally published in 1934.

technocentrists and ecocentrists.¹²⁶ The former are consequentialist in that they value the positive effects biotechnology could have for the environment when balanced against the risk. The latter are more willing to take a rigid stance and reject some or all of biotechnology. To this end they argue on the basis of both consequentialist and non-consequentialist reasons. The following section will show that this debate has entered the policy arena.

Divergence at the Empirical Level — 3. Biotech Policy

The traditional debate over the regulation of biotechnology has been concerned with the importance of ‘*process*’ vs. ‘*product*’. The process view focuses on the methods with which a biotech product was produced. The product view focuses on the properties of the biotech product scheduled for environmental release. There has been a considerable push from the biotechnology community to emphasize product over process. This is compelling from a risk assessment perspective because it is the properties of the product, and not process, which are used to assess the potential health or environmental impacts.

The debate over process vs. product is best understood by considering the diverging conceptions of biotechnology presented earlier in this chapter. Based on the purpose-based conception of biotechnology (**Table 2, Appendix**), it appears to be inconsistent to regulate biotechnology in a unique way. In contrast, based on a the process-based conception of

¹²⁶ Note that my worldview analysis is very different from Norton’s. Neither does he list ‘technology’ in his index to *Toward Unity Among Environmentalists* nor does he refer to attitudes towards technology in the seven worldviews that he identifies.

biotechnology (**Table 1**, Appendix), fundamental ethical questions are pushed into the forefront and the separate regulation of biotechnology becomes plausible.

I have been arguing above, that in the ethics debate the features of the ‘product’ matter from a consequentialist point of view. In contrast, the ‘process’ in which an organism was modified may matter from a non-consequentialist perspective. In other words, the divergence found in environmental ethics and activism are also present in the debate over regulation, although it is sometimes portrayed as a science issue.

The term ‘product’, however, can be understood in two ways — including or excluding a specific use pattern. In the ethics context it is not disputed that intentions matter. Consequently, the intended *purpose* of natural, bred, or biotechnologically altered biologicals needs to be considered. For example, it matters in the environmental ethics context whether the purpose of the release of a microorganism is (a) to maximize the number of cattle which can be sustained in a habitat or (b) to clean-up an oil spill. Further, a claim for good intentions may be put forward as a justification for lenience with the regulation of products. Therefore, purpose, product, and process, and the potential interactions among them, need to be taken into account for the identification of environmental ethics issues.

Based on this terminology, *advocates of ‘enabling’ regulation of biotechnology* give explicit consideration to the products and purposes of biotechnology. These policy makers are interested in making biotechnological methods available to solve problems, for example, to ensure the availability of transgenic organisms for environmental clean-up. This focus on products allows for the argument that the environmental use of biotechnology, and other modifications of the environment, need to be regulated in a similar fashion. A difference may

exist in the rapid rate and extent of change that can be achieved with biotechnology. This, however, is a positive point assuming that purpose (intentions) are morally defensible. These policy makers would be against the view that transgenic organisms should be labelled specifically and would also oppose the creation of specific institutions that regulate biotechnology (i.e., be against a “Department of Biotechnology”). The adoption of this position is facilitated by a focus on consequences.¹²⁷

In contrast, *advocates of ‘restrictive’ regulation of biotechnology* give explicit consideration to the process of the creation of biotechnology (e.g., concern about the dignity of the donors and recipients of the genetic material; patenting). Further, they may be concerned about informing the public regarding the process, for example in the form of a special label for biotech products. The creation of a dedicated institution dealing with biotechnology makes sense from this viewpoint.¹²⁸ The adoption of this position is facilitated by a consideration of non-consequentialist beliefs.

It should be noted that non-consequentialist concerns in the biotechnology debate fit poorly into the existing regulatory system, which was developed for chemicals. Consequently, such concerns are not always open for debate within those systems. An

¹²⁷ Non-consequentialist considerations, however, may come into play when a product is justified based on its purpose. For example, one could argue for an ‘absolute duty to do *everything* in our power to feed the poor’.

¹²⁸ The divergence between these two approaches is also an international matter. Canada, for example, regulates novel traits in plants — the means by which the plant incorporated this novel trait is irrelevant with respect to triggering Canadian regulation. In contrast, the trigger for regulation of a plant in Europe is the process used to create the variety. Bill Anderson, “Market Access Issues for Canadian Seeds,” *AgBiotech Bulletin* 7/2 (February 1999): 8.

overriding practical reason may be, for example, the requirement for consistency in the comparative risk assessments between chemical and biological products. Further, the creation of a risk/ethics boundary in environmental regulation protects the 'experts' (scientists, risk assessors) from worries over non-consequentialist ethics.¹²⁹

I want to expand on the topic of risk assessment to show where biotechnology is located relative to other environmental technologies in the risk assessment context. There is a long list of the *potential* risks from the deliberate environmental release of biotechnological products, and some are unique to biotechnology.¹³⁰ There are, however, not enough empirical data available to develop models to predict the probabilities of incidence of all of these risks. Therefore, it is more precise to say that these risks represent a list of potential hazards for which we know more about their potential magnitude than their likelihood. Despite this problem it is required to select the plausible hazards and estimate risks of biotechnology as well as it is presently possible.

Prior to their environmental release, products for environmental use are evaluated in terms of risk assessments or cost/benefit analyses. Risk assessment is the estimation of the probability and magnitude of adverse effects of an activity and is typically done according to

¹²⁹ See on this topic: Les Levidow and Susan Carr, "How biotechnology regulation sets a risk/ethics boundary," *Agriculture and Human Values* 14 (1997): 29-43.

¹³⁰ See, for example: Jane Rissler and Margaret Mellon, *The Ecological Risks of Engineered Crops* (Cambridge, Mass.: MIT Press, 1996), 168 pp. – Also:

Morris Levin and Harlee Strauss (eds.), *Risk Assessment in Genetic Engineering: Environmental Release of Organisms* (New York: McGraw-Hill, 1991), 403 pp.

George Tzotzos (ed.), *Genetically Modified Organisms: A Guide to Biosafety* (Oxford: CAB International, 1995), 213 pp.

Klaus Wöhrmann and Jürgen Tomiuk (eds.), *Transgenic Organisms: Risk Assessment of Deliberate Releases* (Basel: Birkhäuser Verlag, 1993), 265 pp.

a guideline, for example a government regulation or an international standard. Benefits can be assessed in a similar fashion. If the currency between 'risk' and 'benefit' is the same (e.g., money) then the two assessments are typically completed by the same analyst in a cost/benefit analysis. If the currencies are different (e.g., high probabilities of creating jobs vs. killing birds) then risks and benefits will be contrasted in a more complex 'risk management process' which is often done in isolation from risk assessment. The activity of risk assessment is 'scientific' in the sense that it is based on scientific models and because value judgements take place independent of the actual assessment — either before or during guideline development, or after the risk assessment in the risk management step.

There is a reciprocal interaction between risk and ethics in the sense that (a) only actions which pose a risk to our social, environmental or health values are subject to ethical evaluation and (b) only the effects of actions which may violate our values are considered in risk assessment. The same can be said for the interaction between benefits and ethics.

The question of the location of environmental ethics issues within the risk/benefit analysis arises. The following table contains a comparison of biotechnological products with natural biologicals or breeds, and chemicals.

Environmental ethical issues raised by the deliberate environmental release of...		Independent of any risk assessment	As a result of risk assessment	
			Independent of identified risk in ordinary risk assessment	As a result of identified risk
Chemicals		Chemicals do not give rise to ethical issues independent of risk.	Justification for the inherent value assumptions in ordinary risk assessment (e.g., choice of the subjects for which risks are being assessed; choice between best-case and worst-case approaches or levels of precaution, etc.).	Harm to ecosystem, habitat, endangered species, sentient beings, environmental justice ...
Natural Biologicals Breeds	non-living	Suffering or dignity of the source organism or organism to be released.	Like above if an ordinary risk assessment is done (e.g., microbial pesticides). Often these products are only compared to a 'blacklist' (of weeds and pests) and, if not listed, presumed safe.	
	living	Interference with the telos of an organism (non-living and living products may have to be differentiated in the ethical analysis).		
Biotech Products	non-living	Like above, plus: Harm to the dignity of the donor organism; nature of genetic modification is a consideration; concerns over patenting and public information.	Either: Like in the case of chemicals if they are regulated according to 'process'.	
	living		Or: Like living natural biologicals if they are regulated according to 'product' and judge 'substantially equivalent' to a traditional breed.	
Type of Ethical Issue:		Intrinsic, or Non-Consequentialist	Implicit Consequentialist	Explicit Consequentialist

This overview illustrates the following two points. First, a differentiation between biologicals (e.g., cultivars, field-collected biological control agents, compost) and chemicals has been traditionally made in some regulatory contexts. The difference is very significant with respect to what regulatory hurdles the manufacturers face. Chemicals are typically considered potentially harmful until proven otherwise. With natural biologicals, however, a shift in the burden of proof usually takes place. Natural biologicals are, often, regarded to be harmless until proven otherwise (if they are not, e.g., microscopic and aerially applied). This applies especially to breeds of species that are known to be harmless. This could be interpreted as the manifestation of leniency towards the ‘natural’ and scepticism towards the ‘artificial’. Biotech products represents the middle ground — they are biological and artificial. Consequently, there is a problem in deciding how to approach the regulation of biotech products within the traditional regulatory framework. This leaves the debate wide open to choose between regulating them based on ‘process’, by emphasizing that they are ‘artificial’, or based on ‘product’, by emphasizing that they are ‘biological’.

Second, the existence of a sharp risk/ethics boundary cannot be justified. Biotechnology gives raise to ethical issues independently of risk assessment and within risk assessment there are implicit and explicit value judgments made regarding the threat of biotechnology to cause harm to society, animal and human health or the environment. A ‘convergence’ in the ethical evaluation seems to take place once a risk assessment has been completed. The results of risk assessments creates a common currency for the various products — their risk provides a scientifically based quantity that can be used in legal and

international trade contexts. Once the risk is known it is easier to de-emphasize the non-consequentialist and implicit consequentialist issues.¹³¹

In this section I have documented that the divergence between ‘process’ and ‘products’ in the regulatory context is yet another manifestation of the two different ways of conceiving biotechnology discussed earlier in this thesis. As within environmental activism, it is possible to frame the debate using the ‘consequentialist’ vs. ‘non-consequentialist’ language. I have also shown that the choice between these two approaches to regulation may have significant consequences for the structure of government and for the regulatory requirements that manufactures have to meet. Finally, I have illustrated that risk assessment, when conducted within a strict risk/ethics boundary concept, will lead to a ‘convergence of the ethical issues’ in that everything becomes reduced to the common currency ‘risk’ — a consequentialist concept. This concludes my analysis of the ethical issues given rise by biotechnology.

¹³¹ It is tempting to speculate that the recent policy problems regarding biotechnology are rooted in the following mis-communication. On the one side, industry experts, regulators, and politicians embrace the model of a science-based and apparently value-free risk assessment and *assume* that this approach best represents the interest of the public. On the other side, non-government organizations and members of the general public *assume* that the obvious non-consequentialist ethical problems can and will be incorporated into policy decisions.

Biotechnology: A Suitable Test Case for Norton's Convergence Hypothesis

I have divided this chapter into a theoretical level and three different empirical levels. I used this division for the sake of convenience and not to suggest that these levels are independent and always clearly discernible. A common thread, however, has emerged. I have shown that (1) both non-consequentialist and consequentialist concerns over biotechnology have theoretical foundations in environmental ethics, (2) similar concerns are manifest within environmental activism, and (3) become manifest in the debate over 'process' vs. 'product' in the regulation of biotechnological products. I have also shown that fundamentally diverging conceptions of the classification of biotechnology and attitudes towards technology are intertwined with this description.

Bryan Norton states that the Convergence Hypothesis can only be falsified based on a real policy issue but not based on a theoretical possibility.¹³² Consequently, it is necessary to be precise about how realistic the biotechnology example is. I have attempted to provide evidence supporting the following argument in the previous section:

- (1) A conflict exists among environmentalists regarding biotechnology. Advocates argue for the positive consequences biotechnology could have for the environment. Opponents doubt this or, more important in the context of this paper, argue that the end does not justify the means.

¹³² Norton, "Convergence and contextualism: some clarifications and a reply to Steverson"

- (2) This conflict is not marginal or merely theoretical. Instead it has reached the level of national and international policy (e.g., the emerging Biosafety Protocol of the United Nations).
- (3) This conflict cannot be easily explained as being caused by ‘flawed science vs. sound science’, poor communication, irrational thought, or mass-hysteria. Such explanations could only address the concerns opponents have regarding risks (consequences). Instead this conflict can be easily explained considering the diverging value-frameworks many of which have been articulated in theories of environmental ethics, for example in terms of the divergence between consequentialist and non-consequentialist value systems.
- (4) Thus there is a strong case that the disagreement among environmentalists with respect to biotechnology occurs in actual rather than merely imaginary debate, it involves disagreement at the policy level, and conflicting policy conclusions are derivable from conflicting ethical premises.
- (5) I conclude, therefore, that biotechnology provides a suitable test case for Norton’s convergence hypothesis.

THE TEST: NORTON'S CONVERGENCE HYPOTHESIS FALSIFIED?

I provided a detailed description of Norton's Convergence Hypothesis in Chapter 1, and in Chapter 2 I argued that biotechnology is a suitable case for testing this hypothesis. In the four sections of this final chapter I shall (1) conduct the test, (2) discuss a possible extension of the convergence project, (3) evaluate implications for dialogue over environmental policy, and (4) provide brief conclusions. First, however, I re-state the version of Norton's Convergence Hypothesis that I test (labelled [C6] above):

The convergence hypothesis, which I have offered as an alternative to the traditionally divisive characterization of environmentalists as split between "shallow," anthropocentric, resource managers and "deep," non-anthropocentric, environmental radicals, states that *provided anthropocentrists consider the full breadth of human values as they unfold into the indefinite future, and provided nonanthropocentrists endorse a consistent and coherent version of the view that nature has intrinsic value, all sides may be able to endorse a common policy direction* [emphasis in text].¹³³

A Test of the Convergence Hypothesis

Two approaches to a critique of the Convergence Hypothesis are possible. First, one may want to question the entire approach. This could be a fundamental critique of environmental pragmatism and moral pluralism as viable options. More specifically, one could question the extent to which the constraints specified in the Convergence Hypothesis are justifiable on theoretical, metaethical or methodological grounds. I have already discussed

¹³³ Norton, "Convergence and Contextualism: Some Clarifications and a Reply to Steverson," p. 87.

this point to some extent in the first chapter of this thesis. I have noted some problems of clarity and will further comment on these here.

Second, one could question whether Norton's constraints are effective — is unity among environmentalists (at the policy level) plausible for a given test case? This approach is suggested if one wants to satisfy Norton's own demand for an empirical¹³⁴ test of the Convergence Hypothesis. An empirical falsification also provides the strongest case, i.e., if one takes Norton's hypothesis as clear and testable, attempts to support its accuracy but fails, then serious questions about its universality arise. I am focussing on this second approach.

I have made the point in the previous chapter that much of the divergence among environmentalists over biotechnology can be accounted for by disagreement over whether or not non-consequentialist issues ought to be considered. This could be exemplified, for example, by the potential disagreement over biotechnology between theories of 'animal rights' (deontological) and 'animal liberation' (utilitarian).¹³⁵ Such hypothetical considerations, however, do not provide the basis for a test of the Convergence Hypothesis that would satisfy Norton, who insists that it be tested with a real-world policy example. There is no shortage of controversial issues over biotechnology at the practical level. The contemporary controversy over transgenic food is a real-world situation and provides a good example of the divergence among environmentalists.

¹³⁴ I stated in the first chapter that Norton's Convergence Hypothesis is 'empirical' only in a very broad sense. Norton himself points out that it is "a very general empirical hypothesis." Nevertheless, the labels "empirical" and "testable" give the impression that the Convergence Hypothesis is very sharply defined even though admittedly it is not.

¹³⁵ Based on my interpretation, the former would categorically reject *some* form of biotechnology while the latter would base an evaluation on the expected consequences.

Some, but not all, environmentalists are questioning the risks of food biotechnology (to human health and to the environment) and, sometimes, political and social issues such as the monopolization of food resources. They would, in principle, see a positive role for biotechnology in replacing the need for chemicals. For example, if the Indian government would use public funds to create a transgenic rice plant that is safe, reduces the need for pesticides or fertilizers, and provided this plant to Indian farmers, then these consequentialist minded environmentalists would applaud such a project.

In contrast, other environmental activists are categorically against such fundamental modifications of food plants. This, they argue, is a new level of modification that is clearly different from traditional breeding. Like traditional breeding, it will permanently alter nature in a profound way. Unlike breeding, however, genetic engineering makes nature our *designed* creation, our artefact, they would argue. Some of these activists are fundamentally against what they call domineering (and “non-democratic”) technology, or even all of modern agriculture — the most ‘sophisticated’ form of agriculture being the worst offender (because they disagree that such agriculture is truly sophisticated, a term they would only apply to the “gentle and wise use” of natural resources.). They may consider biotechnology a manifestation of hubris and would argue that we have no right to dominate nature in this fashion and to design organisms according our wishes, nature without human artefact must be maintained like a unique piece of art and its unique qualities must not be destroyed — it is wrong to make life a commodity, and to possess and patent it, they would argue.

I have noted above, however, that environmentalists do not always separate the issues well and that the categorical rejection of transgenic plants on non-consequentialist grounds may be accompanied by statements that express concerns over risk.

How would the Convergence Hypothesis fare based on this test case? Unfortunately, it is not easy to provide a simple test of this “empirical” hypothesis. This is not because biotechnology is an unsuitable test case. Instead, as I have noted in Chapter 1, there are ambiguities in the formulation of the Convergence Hypothesis. The most critical ambiguity is the question of what Norton expects as “a consistent and coherent version of the view that nature has intrinsic value”.

The debate over the term ‘intrinsic value of nature’ arguably *is* environmental ethics.¹³⁶ This debate was already underway when Holmes Rolston III introduced environmental ethics to mainstream philosophy with his publication in *Ethics* in 1975¹³⁷ and it remains central and unresolved. For example, Andrew Brennan calls it the foremost pending problem, in his recent draft entry on environmental ethics to the *Stanford Encyclopedia of Philosophy*.¹³⁸

¹³⁶ Note that an array of similar terms and different possible understandings have been debated. For example, ‘intrinsic value’ has been distinguished from ‘inherent value’ in the sense that ‘value in itself’ is different from ‘value for itself’. Further, the terms ‘sake of its own’, ‘worth in its own right’, ‘own well being’, ‘welfare of its own’, etc. have been used more or less synonymously.

¹³⁷ Holmes Rolston III, “Is There an Ecological Ethic?”. The idea of intrinsic value of nature is expressed by Richard Sylvan (Routley)’s “last man example” in “Is There a Need for a New, an Environmental, Ethic?” *Proceedings of the XV World Congress of Philosophy* (Varna, Bulgaria, 1973), No. 1., pp. 205-120.

¹³⁸ Available on the internet at <http://plato.stanford.edu/entries/ethics-environmental/>. Nevertheless, the term ‘intrinsic value’ is being used in mainstream documents, e.g., The Canadian Biodiversity Strategy (signed by provincial and federal authorities) and in the draft version of the upcoming Earth Charter (successor to the Rio Declaration, see below).

It may be impossible to guess what Norton considers (or to argue what he ought to consider) a ‘consistent and coherent version of intrinsic value’. A case in point is Steverson’s reply to “Convergence and Contextualism: Some Clarifications and a Reply to Steverson” where Steverson points out that Norton misunderstands how he (Steverson) used the term ‘intrinsic value’.¹³⁹ Nevertheless, I am going to discuss the two following interpretations — a narrow and a broad and conception of what a ‘consistent and coherent version of intrinsic value’ could be.

Testing the Convergence Hypothesis — First Run (Narrow Conception)

Within a narrow conception, all metaphysical concepts, including intrinsic value, dignity of animals, respect for the *telos* of a life form, organicism applied to ecosystems or the planet, etc., would have to be stripped of their metaphysical content for the purpose of a dialogue over policy. I have discussed above that Norton takes a critical position towards metaphysical language. Therefore, it is plausible that he would demand such a narrow conception of intrinsic value and related terms. Norton seems to propose that assertions of intrinsic value should be replaced by assertions of instrumental value. He shows how the concept of instrumental value could be broadened to achieve this goal in his *Why Preserve Natural Variety?*¹⁴⁰

¹³⁹ Steverson, “On Norton’s Reply to Steverson”, p. 335.

¹⁴⁰ Norton, *Why Preserve Natural Variety?* See also Andrew Brennan, “Moral Pluralism and the Environment.”

Unfortunately, Norton largely omits the issue of technology in his book *Toward Unity Among Environmentalists*. This is surprising, because most books on environmentalism present the attitude of environmentalists towards technology as a core issue.¹⁴¹ Further, to my knowledge, he never explicitly discusses the divergence between consequentialist and non-consequentialist positions within environmental ethics. Because of these omissions it is difficult to be certain how Norton would apply his position towards non-consequentialist objections to technology in general, and biotechnology specifically. Statements by two other like-minded authors may serve as substitutes.

John Passmore, in the concluding chapter of the classic *Man's Responsibility for Nature*, writes "Science and technology, democracy and free enterprise have always had their enemies; mysticism, primitivism, authoritarianism have always had their adherents".¹⁴² And Bernard Rollin states "The first [category of objections against the genetic engineering of animals] are essentially spurious issues of the sort we have already described — fear of the unknown and the misunderstood, ignorance, aesthetic revulsion, religious distaste, all sloppily categorized as ethical concerns" [the second and third categories are the potential risks and

¹⁴¹ For example, Pepper, *Modern Environmentalism*, see also Arne Naess, *Ecology, Community and Life Style* (New York: Cambridge University Press, transl. and edited by David Rothenberg, 1989).

¹⁴² John Passmore, *Man's Responsibility for Nature: Ecological Problems and Western Traditions*, second edition (London: Duckworth, 1980), p. 173.

Note: Norton and Passmore are not like-minded on all issues. Passmore's main point is that there is no need for an environmental ethic — much of the early debate in environmental ethics was focussed on refuting Passmore.

the pain and suffering of the engineered animals, respectively.]”¹⁴³ These authors would likely argue that metaphysical language used in a critique of technology must be translated into non-metaphysical terms.

The idea of avoiding metaphysical language in the policy context can, according to Norton, be based on the example set by Aldo Leopold. I mentioned above that Leopold did not use metaphysical language when he was engaged in a dialogue over policy (according to Norton). Following Leopold’s example, the second constraint of the Convergence Hypothesis can be understood as a proposal for radical environmentalists to express themselves in a language that can be understood by resource managers. By doing so they express themselves in the same fashion as a weak anthropocentrist would — values become instrumentalized and metaphysical commitments are avoided.

Is this constraint justifiable? I would argue that Leopold’s diplomacy could be judged in two different ways. One could consider it to represent no more than a translation of the language environmentalists use into language familiar to policy makers — a simple courtesy. If everybody talks about what we humans want then at least there is a common basis on which consensus becomes plausible. But one could also consider it a deception and an act of surrender to the power held by policy makers.

One has to question the accuracy of the translation of non-anthropocentric and non-consequentialist values into non-metaphysical language. Arguably, this translation leaves much of the meaning of the metaphysical language behind. One reason for using

¹⁴³ Bernard Rollin, “Send in the Clones ... Don’t Bother, They’re Here,” *The Journal of Agricultural and Environmental Ethics* 10 (1997): 25–40, quote on p. 29.

metaphysical language is that it is uncompromising. A translation of metaphysical language into talk about preferences — what we value, or how we want to live — enables the balancing of some desires against others. Such translation would render radical environmentalists more compromising and a consensus may be achievable. Radical environmentalists, however, may want to prevent the balancing of some desires against others and choose metaphysical language to express this. Some environmentalists (in particular radical environmentalists) use non-consequentialist terms to debate values or the way we want to live. They push another question — what we *ought* to value, or how we *should* want to live — into the foreground.¹⁴⁴ In this case, the translation leads to the loss of an essential element — the unwillingness to compromise. An example shall illustrate. The non-consequentialist prescription “It is wrong to dominate nature by using biotechnology” could be stripped of its metaphysical content and translated into “We prefer not to dominate nature by using biotechnology”. This preference could then be traded-off against other preferences, desires or interests, for example, the preference to feed the world. Part of the original content, however, that we *should* not want biotechnology to be used, becomes lost.¹⁴⁵

¹⁴⁴ Another way of putting it, is they do not want to simply promote happiness but, instead, *deserved* happiness.

¹⁴⁵ At the level of a human individual, the difference between (a) following first order volitions of the type “I desire to smoke” and (b) formulating second order volitions of the type “I do not want to desire to smoke” is very significant. Harry Frankfurt argues that the ability to formulate volitions of the second order is the criterion of personhood. Therefore, personhood requires that we reflect on our preferences. I would add, that *social personhood* requires that we do this not only in terms of predictions but also morally, in terms of prescriptions. Harry Frankfurt, “Freedom of the Will and the Concept of a Person,” *Journal of Philosophy* 68/1 (1971): 5-20.

Val Plumwood criticises Norton on similar grounds. She argues that his approach may be counter-productive. Norton's approach creates a *disguised* non-anthropocentric ("anti-anthrocentric") ethic which is inferior to an explicit ethic in several ways because, for example, it does not provide any conceptual means for dealing with conflicts of interests, in contrast to an explicitly non-anthropocentric ethic.¹⁴⁶

I would add that the anthropocentric position puts *the burden of proof* upon the shoulders of advocates of non-anthropocentric ethics. The reverse is the case if non-anthropocentrism is adopted.¹⁴⁷ Thus, even if convergence is possible the choice between anthropocentric and non-anthropocentric language is important. Environmentalists are aware of this implication and have so far been successful at introducing the term 'intrinsic value' into public documents. It is not clear, however, whether the signatories of the various accords understand the meaning of this expression (and if not, they hardly could be blamed).

Therefore, the exclusion of metaphysical language leads to the loss of significant components contained in the position of radical environmentalists. The Convergence Hypothesis, then, would represent a 'conquest' rather than a true convergence according to the terminology used in Chapter 1. With one strike of the conceptual sword Norton cuts off non-anthropocentrism — based on the rejection of metaphysics — and with a second strike he rejects strict traditional ethics as non-environmental and therefore not of concern to the unity project. When confronted with the issues raised in this thesis it is likely that he would

¹⁴⁶ Val Plumwood, "Androcentrism and Anthrocentrism: Parallels and Politics," *Ethics and the Environment* 1 (1996): 119-152.

¹⁴⁷ For this point I am indebted to Alan McGowen and his posting of 26 August 1997, to the enviroethics news listserver (enviroethics@mailbase.ac.uk).

strike a third time to also separate permissible consequentialist views from non-permissible (metaphysical) non-consequentialist concerns.

I argue that such a narrow conception of 'intrinsic' value would be unreasonable when the goal is the development of a common policy direction *that ought to represent the goals of environmentalists of all stripes*. This form of convergence would illustrate rather the conviction that some environmentalists' beliefs will fare poorly in the present legalistic power struggle of environmental policy and that they best not engage in the dialogue because they cannot possibly succeed. This argument may be acceptable if, at the end of the day, common goals are achieved. The argument does not work, however, when there is significant divergence over the choice of the means that ought to be used to accomplish environmental protection.

This evaluation of the Convergence Hypothesis leads to its rejection on the grounds that it does not represent true convergence. Therefore, it is not only rejected because it cannot accommodate for the divergence between consequentialist and non-consequentialist positions but even its main thrust, the convergence between anthropocentric and non-anthropocentric positions is rejected.

Testing the Convergence Hypothesis — Second Run (Broad Conception)

Within a broad conception, definitions of intrinsic value would be acceptable, provided that they are consistently used within the constraints of a coherent theoretical framework (such as biocentric ethics). Based on such a conception of intrinsic value, environmentalists could argue that they are referring, for example, to Paul Taylor's arguments in support of the

view that the telos of each individual of any living organisms should be respected (except if *vital* human needs are at stake).¹⁴⁸ If Norton would subscribe to such a broad conception of a ‘consistent and coherent version of intrinsic value’, then the test of the Convergence Hypothesis would look as follows:

(1) Advocates of biotechnology would continue to *fundamentally* embrace some or all types of biotechnology even when they subscribe to ‘weak anthropocentrism’ and are willing to “protect the biological bequest to future generations”.¹⁴⁹ In other words, biotechnology is compatible with sustainable development and ecosystem health concepts. In contrast, it is difficult to see how stopping the progress of biotechnology would add significant instrumental value to the “full breadth of values” considered by weak anthropocentrists.

(2) Opponents of biotechnology would continue to *fundamentally* reject some or all types of biotechnology in a policy debate even if they would have to adhere to the (arguably consistent and coherent) version of intrinsic value specified, for example, in biocentric ethics. In other words, the adoption of the view that nature has intrinsic value (in the biocentric conception) leads to the prescription “Do not interfere with the telos of other life forms by biotechnological means.”

(3) Therefore, the constraints will not lead to “unity among environmentalists of all stripes” and not “all sides” will be able to endorse a common policy direction. In other words, the Convergence Hypothesis would be *falsified*.

¹⁴⁸ Taylor, *Respect for Nature*

¹⁴⁹ Norton, “Convergence and Contextualism: Some Clarifications and a Reply to Steverson,” p. 99.

The result, that the Convergence Hypothesis does not work for the example of biotechnology, does not imply that convergence never takes place. Instead, it implies that convergence is very doubtful in the case of *one* broad and important issue within environmental policy — an issue where the divergence between consequentialist and non-consequentialist positions surfaces. Consequently, this result indicates that the unity claim of the Convergence Hypothesis is false: the convergence between anthropocentric and non-anthropocentric positions is *not* equal to the convergence of environmentalists of all stripes.

The split between ‘shallow’ and ‘deep’ environmentalists is not only based on the fact that the former are more concerned with short-term productivity and the latter value long-term stability of the environment more highly. Instead, the split is also between environmentalists who take the position that the end justifies the means vs. environmentalists who wish to emphasize our duties towards nature.¹⁵⁰ This split may not be a new problem in environmental ethics but its importance becomes accentuated in the case of biotechnology — a technology which is not only discussed with respect to its potential effects but also with respect to its status as a permissible method. Norton did not formulate the convergence hypothesis to account for this disagreement, i.e., to argue that non-consequentialist and consequentialist views could be reconciled. Consequently, when tested against the case of

¹⁵⁰ Norton addresses the question of means only briefly in *Toward Unity Among Environmentalists*: “An important continuing debate will concern the proper *means* by which morally supported standards should be achieved, as environmentalists argue to protect rights to a clean environment and balancers emphasize market-incentive approaches.” (p. 134, emphasis in text). He adds that environmentalists would be well advised to “seek the most efficient means to achieve a healthy environment” (p. 135).

the deliberate environmental release of biotech products, the ‘unity claim’ of the Convergence Hypothesis must be rejected.

This test of the Convergence Hypothesis, based on a broad conception of what is acceptable to represent a consistent and coherent version of intrinsic value, is not a complete rejection of the Convergence Hypothesis. Instead, one limit of its applicability has been revealed. It is inviting to propose additional constraints that express this limit and, thus, would protect the Convergence Hypothesis from being falsified by test cases such as biotechnology policy. I shall attempt such an extension in the next section. First, however, I provide a brief summary of the test of the Convergence Hypothesis.

An Appraisal of the Convergence Hypothesis

I have now shown that two different conceptions of what is meant by ‘consistent and coherent version of intrinsic value’ leads to two different conclusions of the empirical test of the Convergence Hypothesis. Both conclusions, however, represent significant criticisms of the Convergence Hypothesis. The Convergence Hypothesis represents an over-generalization in one of the following two senses.

In the first case the constraints specified in the Convergence Hypothesis are shown to be *unreasonable*. Even if a common policy direction is achieved this way it would in no way represent unity among environmentalists — too large a portion of environmentalists is excluded from participation in the dialogue over environmental policy formulation. Or, alternatively, radical environmentalists would give up too much should they join the dialogue and abandon their metaphysical language.

In the second case the Convergence Hypothesis is *falsified* and Norton's challenge for empirical falsification, thus, would be addressed. The Convergence Hypothesis cannot be applied to all environmental policy issues because, for example, non-consequentialist concerns over biotechnology cannot be covered. As a result, the Convergence Hypothesis would have to be reformulated to reflect the lack of applicability to biotechnology or more generally to policy issues over means rather than ends.

In short, the Convergence Hypothesis does, perhaps, not address true convergence; if it does, then it does not always work.

An Extension of the Convergence Project: Precautionary Convergence

At least in the case of biotechnology, Norton's Convergence Hypothesis requires an extension to procure convergence between consequentialist and non-consequentialist positions. In this section I propose a procedure for how such a convergence might be accomplished within a technology assessment context.

At the level of environmental ethical theory the need for extension can be visualized as follows. In the first chapter I noted that the development of the conception of environmental ethics from Holmes Rolston III to Baird Callicott and Bryan Norton is based on emphasizing two different dimensions, namely (1) anthropocentrism vs. non-anthropocentrism and (2) individual organisms vs. ecosystems. How does the addition of the third dimension, (3) consequentialism vs. non-consequentialism, affect this picture? A three-dimensional classification of environmental ethical theories would take this form:

<i>Environmental Ethics: A three-dimensional affair?</i>		<i>Moral Considerability</i>	
		<i>Anthropocentric</i>	<i>Non-Anthropocentric</i>
<i>Consequentialist</i>			
<i>Unit of Observation or Moral Considerability</i>	<i>Individuals</i>	Traditional ethics (e.g. utilitarian).	Animal liberation (e.g., Peter Singer).
	<i>Ecosystems</i>	Weak anthropocentrism (Bryan Norton)	Land ethic (as interpreted by Baird Callicott).
<i>Non-Consequentialist</i>			
<i>Unit of Observation or Moral Considerability</i>	<i>Individuals</i>	Traditional ethics (e.g., Kantian).	Animal rights (e.g., Tom Regan); Biocentric ethics (e.g., Paul Taylor).
	<i>Ecosystems</i>	'Extended weak anthropocentrism' (hypothetical)	Deep ecology (components only?)

'Extended weak anthropocentrism' is a label that I introduce here as a placeholder for a potential theory that would be based on Norton's weak anthropocentrism and would explicitly incorporate non-consequentialist principles applied at the system level. To my knowledge there is no environmental ethical theory that could be classified as anthropocentric, ecosystem-based, and non-consequentialist.

This conception of environmental ethics has the advantage that clearly different positions, such as those of Peter Singer and Tom Regan, become visibly separated. I do not, of course, claim that the differentiation between consequentialist and non-consequentialist ethics has been overlooked in environmental ethics! I do claim, however, that it deserves

more attention relative to the almost overwhelmingly ‘loud’ debate over anthropocentrism vs. non-anthropocentrism.¹⁵¹

How would such a conception of environmental ethics translate into the policy context? Is a convergence between consequentialist and non-consequentialist positions plausible and what are the prospects for the formulation of an extended weak anthropocentrism? I have noted above that environmentalists sometimes combine fundamental objections with concerns over risk. When somebody states “this is fundamentally wrong and the risk may be substantial” then one is left with the impression that a better understanding of risk may soften this rigid non-consequentialist stance. In other words, a shift from a non-consequentialist position to a consequentialist position might be contingent on an understanding of the risks.

Based on this observation, I make two proposals within the realm of technology assessment. The first is that consequentialism is reasonably adopted by environmentalists when consequences can be adequately forecasted. The second is that non-consequentialism is reasonably adopted by environmentalists when it is clear some elements cannot be

¹⁵¹ Other approaches to the mapping of the theoretical terrain are possible. Andrew Brook differentiates nine different dimensions: (1) Scope, (2) Kind of value, (3) Kinds of states and processes valued, (4a) Place of the individual as object of the theory, (4b) Place of the individual as subject of the theory, (5) Place of the individual as subject of the theory, (6) Basis of ethical concern, (7) Kind of reasoning used, (8) The way values are recognized. Brook’s analysis is designed to guide the development of questionnaires that could be used for the assessment of the environmental values held by citizens (a sociology of ethics context). Andrew Brook, “The Structure of Ethical Positions on the Environment,” in *Research Methods and Ethical Issues Associated with Resource Extraction and Resource Management in Forestry and Mining*, ed. Wesley Cragg and David Pearson (Proceedings of Two Workshops, September 1991 and May 1992).

predicted.¹⁵² Specifically, it is reasonable to shift towards non-consequentialist attitudes when the hazards of a new technology are very substantial (e.g., life-threatening), even when the risk is slim. The perception of how substantial such hazards are is dependent on the level of tolerance, or *precaution*.¹⁵³

The second part of the proposal, then, is: "When the hazards are very substantial, or when the desire for precaution is very high, or when it is doubtful that the risk can be calculated, then one would reject consequentialist calculations in favour of non-consequentialist prescriptions of duty or virtue."¹⁵⁴

¹⁵² Note the close relationship of this approach to the discussion of the Promethian myth presented in the previous chapter.

¹⁵³ Interesting in this context is that insiders (scientists, governments, industry) focus on "How small is the risk?" while outsiders (the public) focus on "How large is the hazard?". See Miles Russell, "Communication Strategies for Accessing the International Market Place," *AgBiotech Bulletin* 6/7 (July 1998): 8-10.

¹⁵⁴ This is somewhat in contrast to Will Kymlicka's recommendation on how to approach public policy over new reproductive technologies (an issue in biomedical ethics) presented in his "Moral Philosophy and Public Policy: The Case of New Reproductive Technologies," in *Philosophical Perspectives on Bioethics*, eds. L.W. Sumner and Joseph Boyle (Toronto: University of Toronto Press, 1996), pp. 244-270. Like Norton, Kymlicka advises against the adaptation of a comprehensive moral theory. Instead, he proposes guiding principles that address the legitimate interests of the affected people — these principles are the outcome of a convergence within traditional anthropocentric ethics. He notes the most of the public disagreements over new reproductive technologies are not about ethics but rather about facts and proposes to improve the factual basis while continuing to allow broad public input. I argue that, while this question for knowledge is taking place (and this may be a lengthy process), people will gravitate towards replacing the lack of understanding with non-consequentialist principles. If this were true then the debate over new reproductive technologies would resemble the abortion debate that is, according to Kymlicka, irreconcilable. Further, I argue below that the quest itself is not independent of values. Based on these two arguments, I believe that it is difficult to escape the debate over moral theories if one lacks satisfying predictions.

This second part can be seen as an additional constraint on environmentalists *necessary* in order to procure convergence on biotechnology. It would represent a shift for consequentialists away from their standard positions to an extended weak anthropocentrism, as distinct from the narrower position advocated by Norton.

In this extended conception, non-consequentialist values are universals, fundamental attitudes, rules of thumb, that provide guidance when uncertainty stands in the way of the prediction of the particular. This proposition softens the dualism between consequentialist and non-consequentialist ethics because if the situation changes an agent could decide whether to apply the universal rule, make an exception, or even switch camps. This proposition is not far removed from the first of the five possibilities for the reconciliation between deontological and teleological views that Robert Nozick lists: "1. Deontology as superstructure. While teleology is the correct theory, deontological rules are good rules of thumb to follow in attempting to maximize the good."¹⁵⁵

Uncertainty over the wisdom of endorsing environmental biotechnology has at least three different sources. (1) Misinformation. According to a recent poll the public is increasingly misinformed about central environmental issues. When presented with ten multiple choice questions on key environmental issues adult Americans fared worse than random guessing would have produced.¹⁵⁶ It is likely that the same would be true for biotechnology. Advocates within the biotechnology debate, for good reasons, often call for

¹⁵⁵ Robert Nozick, *Philosophical Explanations* (Cambridge: Belknap Harvard University Press, 1981), p. 495.

¹⁵⁶ Patrick Connole, "Environmental Issues Popular, Myths Persist," *Reuters Environmental News* (<http://www.planetark.org>, December 14, 1998).

more public information. However, given the rapid progress of science and technology, there is very little hope that the public (or anybody really) will ever catch up.

(2) Uncertainty. Within risk assessment uncertainty has two different sources, natural variability and the limitations of the predictive models. Both lead to the same effect: predictions may be less accurate than required. This point is perhaps best illustrated by the way insurance companies evaluate the risks of biotechnology. The biotech critic Jeremy Rifkin states:

While the public was fed a steady barrage of revised, updated, and reworked regulatory guidelines, giving the appearance of rigorous scientific oversight, the insurance industry quietly let it be known that it would not insure the release of genetically engineered organisms into the environment against the possibility of catastrophic environmental damage because the industry lacks a risk assessment science — a predictive ecology — with which to judge the risk of any given introduction.¹⁵⁷

(3) Values (and trust). The third type of uncertainty is caused by a lack of clarity over which values are being applied by the biotech industry and the regulators of biotechnological products. This uncertainty may be combined with a general lack of trust (fear of corruption etc.).

¹⁵⁷ Rifkin, *The Biotech Century*, p. 79. See also Christine von Weizsäcker, "Lacking Scientific Knowledge or Lacking the Wisdom and Culture of Not-Knowing," in *Coping with Deliberate Release: The Limits of Risk Assessment* ed. A. Van Dommelen (Tilburg: International Centre for Human and Public Affairs, 1996), pp. 195-206.

The idea of precautionary convergence suggests that an extended Convergence Hypothesis would have to incorporate the following additional constraints.

(1) Non-consequentialists must give up strict rules of the kind “Never do X, no matter the consequences” and adopt instead less rigid prescriptions of the kind “There is something so wrong with doing X that only the weightiest of consequences could excuse it.”¹⁵⁸

(2) Consequentialists must give the magnitude of the hazard, the uncertainty of the risk assessment and the precautionary principle serious consideration. This is reflected, for example, in the approach “Prohibiting X is not justified by risk assessment as far as we know, but rather in virtue of high hazard, high uncertainty of risk, and the precautionary principle.”

The explicit introduction of the principle of precaution would lead to a significant change of the Convergence Hypothesis. First, it makes the Convergence Hypothesis more applicable to the policy decisions over technology assessment and pollution prevention. I noted above that Norton excludes “non-environmentalists” from the dialogue over pollution prevention. This may not be necessary if non-environmentalists respect the precautionary principle.

Second, the inclusion of precaution may preclude Steverson’s critique of Norton. I stated Steverson’s argument as follows in Chapter 1. Either a resource manager knows how many species need to be protected to achieve ecosystem health, in which case the manager would protect fewer than deep ecologists demand, or the manager cannot manage for

¹⁵⁸ Note that this constraint represents nothing more than the historical shift in the understanding of the meaning of ‘non-consequentialism’ from Anscombe’s definition to contemporary versions. See Griffin, “Consequentialism”, quoted in Chapter 2.

ecosystem health due to a lack of such knowledge. However, if the resource manager is aware of *imprecise* predictions, takes the magnitude of the hazard into account, and uses the precautionary principle, then the deep ecologist's demand may be satisfied and the manager may not be forced to abandon the ecosystem health goal and the contextual approach.¹⁵⁹

One may summarize these thoughts as follows. Risk management would ideally rely on perfect *descriptions* of the world that, in conjunction with perfect models, would yield perfectly accurate *predictions* of the future states of the world. A normative, *consequentialist* discourse would take place independently of this scientific activity. In the face of massive uncertainty, however, *prescriptions* may have to take the place of predictions. The prescriptive discourse would replace the descriptive/predictive discourse because the latter does not yield any useful results. The content of a prescriptive discourse thus defined would be *non-consequentialist* (e.g., "Respect for Nature" is a wise rule of thumb in the absence of useful predictions).¹⁶⁰

Limitations of Precautionary Convergence

Precautionary convergence may have the capacity to end some policy debates that cannot be addressed by Norton's Convergence Hypothesis. I am not optimistic, however, that it can lead to consensus in all cases. An obvious problem is the lack of agreement over

¹⁵⁹ One could argue that such 'precautionary contextualism' occupies the middle ground between 'contextualism' and 'formalism'.

¹⁶⁰ An aside, in this view, the difference between a technical 'ought' (prediction) and a moral 'ought' (prescription) is a function of uncertainty about the future.

what level of precaution is reasonable. Fundamental attitudes towards science will play a role in how uncertainty is evaluated. On one side of the spectrum, science-minded people will tend to downplay ‘irrational fears’ and attempt to improve the quality of predictions. On the other side, science critics will point a finger towards the powerful interest behind the technology, and the ‘optimism of youth’ of many of the researchers, and try show that sufficiently accurate predictions cannot be made. Further, the toleration of risk, or the demand for precaution, are also dependent on how the environment is valued (and how robust or fragile it is judged to be). David Oderberg and Jacqueline Laing illustrate how these attitudes are linked to consequentialism and non-consequentialism:

It can be seen, then, that consequentialists speak a language technologists and policy-makers instinctively understand, which explains why their proposals are taken seriously. [...] the promotion of consequentialism has gone hand in hand with the denigration of what consequentialists condescendingly call ‘traditional morality’. Familiar charges levelled at anti-consequentialist thinking involve numerous epithets. Such thinking is often described by consequentialists as ‘fundamentalist’, ‘reactionary’, ‘dogmatic’, or ‘essentially religious’.¹⁶¹

This quote leads to the second, more fundamental problem of precautionary convergence: not all issues are related to risk, even if risk is broadly understood. For example, how would one apply precautionary convergence to the debate over the permissibility of the patenting of life forms? Or, how can it affect the question of whether we *ought* to dominate nature in the way now possible through biotechnology? A dialogue that is reduced to risk calculation will not provide a debate over values, i.e., The question “How *should* we want to live” cannot be

¹⁶¹ David Oderberg and Jacqueline Laing (eds.), *Human Lives: Critical Essays on Consequentialist Bioethics* (New York: St. Martin’s Press, 1997), pp. 3-4.

addressed. This point is in agreement with Nozick who adds the following to his statement quoted above:

This view [deontology as superstructure] is proposed by many utilitarian writers; however, it gives deontological considerations insufficient fundamental weight.¹⁶²

A final problem is that the concept of precautionary convergence is overly simplistic. Formulating the issue as one of the 'risk and precaution' is superficial if one takes the criticism of the risk/ethics boundary seriously. I indicated in the last chapter that the view of a strict boundary between risk and ethics cannot be supported. This topic has been addressed by a number of authors.

Risk assessors are 'hidden moralists' according to James Nash¹⁶³ and the hidden normative principles selected will influence the nature of the 'competent, objective advice'¹⁶⁴ they are hired to produce. Nash says of risk evaluation and management that it is "inescapably to some degree a moral enterprise". As 'invisible values' he identifies (a) a focus on risk as a whole rather than on how risk is distributed within a society or among societies ('aggregative prejudice'), (b) a focus on the present or near-future rather than on responsibilities to future generations, (c) a reflection of the anthropocentric imperialism

¹⁶² Nozick, *Philosophical Explanations*, p. 495.

¹⁶³ James Nash, "Risk Decisions and Moral Values," *Symposium on Values, Perceptions, and Ethics in Environmental Risk Decision Making* (Environmental Division, American Chemical Society, 24 August 1994).

¹⁶⁴ As characterized by John Tait, "Values and Accountability," *Canadian Centre for Management Development Armchair Discussion* (Ottawa, 24 March 1998).

dominant in our culture. Stephen Stich points out the dangers of leaving the gap between 'risk' and 'values' unfilled: risk assessment often does not contain an explanation of the invisible values used.¹⁶⁵

Soemini Kasanmoentalib proposes a scheme to locate and identify the values that affect the environmental risk assessment of field experiments with biotechnological products¹⁶⁶. He follows Helen Longino's 'contextual empiricism' (which consists of balancing the sociological constructivist view of science as externally determined against the traditional standard internalistic view). Longino argues that there are at least five ways in which a scientific research process can be shaped by 'contextual values': (1) *Practices* (contextual values can affect practices that bear on the epistemic integrity of science), (2) *Questions* (contextual values can determine which questions are asked and which are ignored), (3) *Data* (the selection and description of data are subject to contextual values), (4) *Specific assumptions* (inferences are dependent on basic assumptions which contain contextual values), (5) *Global assumptions* (framework-like assumptions that determine the character of research in an entire field)¹⁶⁷. This schema is also applicable to risk assessment.

¹⁶⁵ Stephen Stich, "The Recombinant DNA Debate," *Philosophy and Public Affairs* 7 (1978): 187-205.

¹⁶⁶ Soemini Kasanmoentalib, "Science and Values in Risk Assessment: The Case of Deliberate Release of Genetically Engineered Organisms," *Journal of Agricultural and Environmental Ethics* 9 (1996): 42-60.

¹⁶⁷ After Helen Longino, "Gender and Racial Biases in Scientific Research," in *Ethics of Scientific Research*, ed. Kristin Schrader-Frechette (Lanham, Maryland: Rowman and Littlefield, 1994), pp. 139-151.

In the context of the bigger picture of the role of risk assessment in risk decisions

Conrad Brunk and co-workers state:

The conclusion we draw from the alachlor case [the controversy over a potentially carcinogenic pesticide which was de-registered by Canadian authorities] is that the debate over the risk of alachlor is *not* primarily a debate between those who accept the verdict of the scientific risk estimation and those who do not. ... Rather, it is primarily a *political* debate — a debate among different value frameworks, different ways of thinking about moral values, different conceptions of society, and different attitudes toward technology and towards risk-taking itself. ... in this way, what is essentially a value-laden political decision becomes disguised as politically and morally neutral.¹⁶⁸

This conclusion should have serious consequences for the perception and the role of risk assessment — it should be distinguished from pure science as “regulatory and mandated science”.¹⁶⁹

One could attempt to improve management of the implicit values in risk assessment.

This could be an important project. Les Levidow and Susan Carr point out that the risk/ethics boundary encourages public deference to experts: “At stake are the prospects for democratizing the problem-definition that guide R&D priorities.”¹⁷⁰

Ted Schrecker and co-workers ask the question whether there is a need for a ‘fourth regulatory hurdle’ where socio-economic benefits would be identified (the first three hurdles

¹⁶⁸ Conrad Brunk, Lawrence Haworth and Brenda Lee, *Value Assumptions in Risk Assessment: A Case Study of the Alachlor Controversy* (Waterloo, Ontario: Wilfrid Laurier University Press, 1991), pp. 6-7 (emphasis in text).

¹⁶⁹ *Ibid.*, p. 3.

¹⁷⁰ Les Levidow and Susan Carr, “How biotechnology regulation sets a risk/ethics boundary,” *Agriculture and Human Values* 14 (1997): 29-43. Quote on p. 29 (abstract).

for the industry are to provide data on safety, quality and efficacy).¹⁷¹ Such an enriched risk assessment would shift some of the implicitly contained values out into the open. This may be an important step but, nevertheless, there will always be some basic assumptions which have to remain 'hidden' within the foundation of risk assessment.

The interdependence of risk assessment and ethics makes it difficult to argue that a convergence could be expressed in pure 'risk language' alone. It is more correct to recognize that the risk calculation within the consequentialist approach is value-laden and, thus, consequentialist *and* non-consequentialist values become interwoven with the utilitarian calculations. This in itself may not be fatal to precautionary convergence but it illustrates how superficial a reduction to 'risk language' is.

Practical Implications

An understanding of the limitations of the Convergence Hypothesis has practical applications in situations where convergence is implicitly or explicitly used, considered, or needed. I discuss three related issues. First, how the awareness of the existence of non-consequentialist issues is important in the communication of policy makers with the public. Second, how the limitation of the ecosystem health concept as an environmental policy goal

¹⁷¹ Ted Schrecker, Barry Hoffmaster, Margaret Somerville, and Alex Wellington, *Biotechnology, Ethics and the Government – Report to the Interdepartmental Working Group on Ethics* (Unpublished, Westminster Institute for Ethics and Human Values and McGill Centre for Medicine, Ethics and Law, March 1996) p. 123.

needs to be recognized. Finally, how the Convergence Hypothesis could be applied to international trade agreements and environmental policies of the United Nations.

(1) Public concerns are typically assessed by polls. The formulation of the questions used in such polls is crucially important. If we ask, for example, “Do you have full confidence that the biotechnologically altered food on the market is safe to eat?” then most persons in a country may answer “yes”. The conclusion may then be that public confidence in the regulatory agency of the given country is adequate and that no special measures (such as labelling, additional regulatory hurdles, etc.) are needed. The question, however, is already framed the debate in the risk/benefit language.

In contrast, the question “Would you give permission to the genetic engineering of hens with four wings if the manufacturers could offer chicken wings at a 30% reduced cost to the public?” may result in a different assessment of the public’s preferences. For example, an awareness of religious (or quasi-religious) objections to certain forms of biotechnology may emerge. Such an awareness could, for example, completely alter the debate over the labelling of transgenic foods from (a) what such a label could provide in terms of food safety (next to nothing) to (b) what such a label could provide in terms of the protection of personal or religious freedom (a lot).¹⁷² One should note that the temptation of pollsters to focus on risk

¹⁷² A note on the hot topic of the labelling of transgenic food. On the one hand, it is obvious that the labelling of biotechnological products and the neglect of the labelling of chemically treated products is inconsistent (nevertheless adopted by the European Union — a form of ‘moderation’?). On the other hand, it is reasonable to demand that consent is being acquired from consumers. Consumer consent may encompass an array of issues: *who* produces-packages-distributes-sells *where* by what *means*, and *what* is it exactly? Based on this array of information the consumer could check for fundamental (non-consequentialist) violations and conduct a cost/benefit analysis (i.e., judge the price). In other words ‘consent’ is *not* identical ‘to consent to health risk’. Although it is obviously not possible to print all

language is great because this type of language monopolizes the current regulatory frameworks.¹⁷³ In this thesis I have illustrated that agreements at the level of consequentialist goals is not identical to unity among environmentalists and this should be taken into account when ‘consumer preferences’ are assessed.

Communication goes both ways. A related issue concerns the way the public is being informed. This is an important issue because much unnecessary harm can be done if communication is poor.¹⁷⁴ The field concerned with this matter is called *risk* communication because most often the risk is the endpoint of regulatory assessments. Above I have identified three different sources of uncertainty — confusion and misinformation, limited accuracy of predictions, and lack of understanding of underlying values. All three need to be addressed in communications with the public.

If it is true that non-consequentialist values are more often adhered to when there is uncertainty about the consequences of an act, then particular attention to addressing these values should be paid when information is given to the public concerning biotechnology

this information on a cucumber one should note that much of this information is available when environmentalists buy local organic (non-engineered) food. Perhaps some environmentalists are not thinking in these complex ways. Their attitude may be better represented by the following analogy: To a watch-lover, a fake Rolex is by no means similar to a real Rolex, even if these watches are substantially equivalent in terms how good they look, and how accurate and durable they are. Consequently, the watch-lover demands a ‘real’ Rolex, even if only a watchmaker could tell the difference, and even if the vendors argue that the original is *inferior* to the copy in some way.

¹⁷³ It appears also that non-government organization that are critical of biotechnology increasingly adopt ‘risk language’ — consequentialism appears to become adopted in the same fashion Leopold adopted anthropocentric language when faced with policy makers.

¹⁷⁴ Douglas Powell and William Leiss, *Mad Cows and Mother’s Milk: The Perils of Poor Risk Communication* (Montreal & Kingston: McGill-Queen’s University Press, 1997).

regulation. Biotechnology is destined to lead to massive uncertainty caused by both misinformation and the absence of accurate predictions (or the inability to judge how accurate the predictions are). The former is given by the rapid development and the abstract (and microscopic) nature of this high technology. The latter is best illustrated by the way insurance companies evaluate the risks (see Rifkin's quote above).

(2) Norton is a supporter of the concept of ecosystem health¹⁷⁵ which he combines with the convergence project in a pragmatic approach to environmental philosophy. Ecosystem health is loosely modelled after the concept of human health and is gaining acceptance as a policy goal — it has been used, for example, in the Canadian Biodiversity Strategy and is supported by an international society including the dedicated journal *Ecosystem Health*. 'Health', the state of being well, is something everyone wants to achieve and preserve. The formulation of the particular state of affairs that is represented by the health concept is by and large a problem of consequentialist ethics.¹⁷⁶ This claim still holds when 'health' is understood in the more sophisticated ways proposed by Robert Costanza: (1) homeostasis, (2) the absence of disease, (3) diversity or complexity, (4) stability or resilience, (5) vigour or

¹⁷⁵ Robert Costanza, Bryan Norton and Benjamin Haskell (eds.), *Ecosystem Health: New Goals for Environmental Management* (Washington: Island Press, 1992).

¹⁷⁶ In a very indirect way, one could argue that an 'ethical lifestyle', e.g., the fulfilment of one's 'self-legislated duties' (as in non-consequentialist Kantian ethics), is a requirement for the healthy condition. My point is that the fundamental rejection of certain technical practices is not based on the argument that it decreases 'health'. For example, objections to the use of human genes in food production are not based solely on 'health' concerns.

scope for growth, or (6) balance between system components.¹⁷⁷ As a result, the limitations of the Convergence Hypothesis also apply to the ecosystem health concept. Namely, non-consequentialist ethical problems such as the ones raised by biotechnology cannot be accounted for.¹⁷⁸ It is, therefore, important that the ecosystem health goal not become the sole environmental policy issue.¹⁷⁹

(3) A place where convergence *could* play an important role is in the conflict between the advocates of human rights who argue for a human right *to* (a safe) environment and advocates who demand rights *of* environment. The former (anthropocentric) position could be added to existing human rights while the latter (non-anthropocentric) position is compatible with another United Nations resolution — the World Charter of Nature of 1982.¹⁸⁰ Support for Norton's view comes from the Brundtland Commission, initiated in the year after the World Charter was adopted. In the foreword of its report *Our Common Future* the

¹⁷⁷ Robert Costanza, "Toward an Operational Definition of Ecosystem Health" in *Ecosystem Health: New Goals for Environmental Management*, eds. R. Costanza, B.G. Norton and B.D. Haskell (Washington, Island Press, 1992), pp. 239-256.

¹⁷⁸ I argued this point at a recent workshop convened by Elisabeth Boetzkes at McMaster University (2-4 October 1998): *The Ethics of Human Health and Ecosystem Health: Toward an Inclusive Understanding*. My paper "Towards an Inclusive Concept of Health: The 'Moral' from the Limitations of Norton's Convergence Hypothesis" has been submitted for inclusion in the workshop proceedings in the journal *Ethics and The Environment*.

¹⁷⁹ Note also: I have mentioned above that some ecologists do not believe that 'ecosystems' or 'biotic communities' exist. This obviously is a serious challenge to the ecosystem health concept. The ecosystem health concept is effectively based on two components that are unclear: "What is an ecosystem, and what does it mean to be healthy?"

¹⁸⁰ United Nations, *World Charter for Nature* (UN GA RES 37/7, 1982), 4 pp. Available at <http://sedac.ciesin.org/pidb/texts/world.charter.for.nature.1982.html>

commission states: "... attempts to defend it [the environment] in isolation from human concerns have given the very word 'environment' a connotation of naivety in some political circles."¹⁸¹ It is presently not clear where this development of succeeding proclamations is going to lead. The next step will be an Earth Charter which is destined to be tabled in 2002. The *Earth Charter Benchmark Draft* provides an interesting and confusing mix of human rights and rights of environment.¹⁸² Norton's constraints may help to give this debate defined boundaries, direction even, and should be taken seriously in this global context over human and environmental health *goals*.

It is more problematic to achieve international agreement over the use of biotechnology. Attitudes towards biotechnology vary internationally. In the USA, transgenic plants are grown on a massive scale while in England the possibility of a moratorium is being debated. Labels for transgenic foods are not required in the USA (administrators are in fact going so far as considering the inclusion of genetically modified food under a new organic food label) while the European Union and Australia have made labelling mandatory. An international biosafety protocol is in the works to address safety (and trade) concerns. Without going into the details of these debates I can state here that international standard setting should seriously consider non-consequentialist objections despite the resistance of scientists (in both industry and governments). Brushing away these objections as intangible

¹⁸¹ World Commission on Environment and Development, *Our Common Future* [Brundtland Report] (Oxford: University Press, 1987), p. xi

¹⁸² Earth Charter Commission (formed by the Earth Council and Green Cross International), *The Earth Charter Benchmark Draft* (Reviewed and Presented during the Rio+5 Forum on 18 March 1997). 2 pp.
Available at http://www.earthcharter.org/report/rio5/earth_en.html

is not equivalent to convergence. Surely, representatives should accept that religious (or quasi-religious) fundamentalism is not a good basis for the setting of international standards. It is not helpful, however, if legitimate fundamental resistance becomes reduced (using Leopold-type diplomacy) into risk language. If it does, then the process could become confusing — spurious health risks could be made, apparently inexplicably, into obstacles preventing agreement.¹⁸³

At the policy level the core issue is the integration of ethics into the rigid science framework of environmental policy. The case of biotechnology shows that ‘risk talk’ is not sufficient to guide environmental policy making. Implicit environmental ethical commitments contained in scientific assessment need to be laid out in the open. Implicit and explicit values need to be formulated, if possible, using existing terminology from environmental ethics (instead of scientists inventing new words). Public values must be openly assessed, not restricted by a focus limited to risk. Biotechnology has opened the debate over environmental policy — I have provided arguments that the discussion of consequentialist vs. non-consequentialist issues should become part of this debate. Such a debate will raise the issues of the validity of a rigid risk/ethics boundary and the nature of the interaction between risk assessor and risk manager. A new and superior model for environmental policy making may emerge if this debate is taken seriously.

¹⁸³ Note: Val Giddings, vice president of the Washington-based Biotechnology Industry Organisation states the following about the arguments of environmentalists put forward during the last Biosafety meeting in Columbia: “The argument that gene exchange is problematic [i.e., risky] is bogus. Greenpeace and its likes have made a decision for metaphysical reasons that is opposed to biotechnology.” Anonymous, “Greens and Growers Wide Apart on Bio-Tech Food,” *Reuters Environmental News* (<http://www.planetark.org>, 23 February 1999).

Conclusions

Norton's challenge — an empirical falsification of the Convergence Hypothesis — is not as straightforward as he makes it sound. I have shown the presence of a number of ambiguities in his "empirically testable hypothesis". I have attempted, however, to understand Norton's intention. Based on a reading of the Convergence Hypothesis in good faith I have conducted an 'empirical test' with the example of biotechnology (genetic engineering).

This test requires two separate runs. The first run is based on the understanding that Norton strictly rejects metaphysical language. This puts very serious constraints on the dialogue and in particular on the non-anthropocentric position. I have argued that, understood in this way, the Convergence Hypothesis cannot claim to assist environmentalists of all stripes to 'converge'. Instead it forces non-anthropocentrists to give up much of their intent, in particular they have to abandon the question of "how we ought to want to live" in favour of "how we want to live". The Convergence Hypothesis thus understood can be considered *unreasonable* — applying its constraints to a environmental policy dialogue is too much to ask for from the environmental radicals.

The second run of the test of the Convergence Hypothesis is based on the understanding that Norton is less strict in his rejection of metaphysical language. In this case, the position of radical environmentalists (ecocentrists), after application of the constraints, translates into "It is wrong to pursue biotechnology" while the position of conservative environmentalists (technocentrists) translates into "Pursue biotechnology when the ratio between risk and benefit is favourable". The Convergence Hypothesis thus understood can

be considered *falsified*—applying its constraints to a dialogue does not lessen the divergence between positions in the current dialogue over environmental policy.

I have proposed an extension of the Convergence Hypothesis by what I call ‘precautionary convergence’. There may be some merit to consider this amendment. It addresses one of the principle weaknesses of Norton’s hypothesis, namely that he fails to take non-consequentialist issues into consideration, but it is doubtful that it would solve all problems.

In summary, my main criticism is that Norton over-generalizes. The Convergence Hypothesis cannot hold up its global claim of achieving “unity among environmentalists of all stripes”.

Biotechnology is a suitable test case and its use reveals limitations of the Convergence Hypothesis. Not only the outcome of the use of this technology, but the very use itself raises policy (and ethical) issues. For the environmental issues that Norton discusses in *Toward Unity Among Environmentalists* the idea of the interpenetration of human and non-human interests may be plausible. It is difficult to argue, however, that the commodification of nature and the transformation of living beings into artefacts could be in the ‘interest’ of non-humans. The heated debate over the environmental use of biotechnology seems to support this point.

Biotechnology is also a good example because it challenges the policy tradition over the assessment of technology. Traditionally, convergence over policy directions may have been possible, because the risk model could dominate and non-consequentialist concerns were pushed into the background. In the case of biotechnology, non-consequentialist

concerns (of all kinds) are pushed into the forefront, the concept of the risk/ethics boundary becomes more clearly challenged, and the convergence model loses its fit to the empirical reality of how environmental policy works. It may be more difficult to achieve consensus over environmental policy in the case of biotechnology. This, however, can be taken as an opportunity to reassess the validity of the traditional risk assessment model — an improved approach may emerge.

APPENDIX

Table 1: The 'process-based conception of biotechnology' — a classification of existing and theoretical biologicals for environmental use based on the process of their creation (in the context of environmental ethics).

Technology	Kinds of Modifications	Kinds of Donors	Kinds of Recipients	Quantity of Transfer
Use of Natural Biologicals	'Random' but limited by natural selection. No human intention and selection. No modification in clones.	Parents; <i>or</i> Less typically: other species (mostly micro-organisms).	Offspring; <i>or</i> Less typically: other species (mostly micro-organisms).	Massive mixes within species boundary (when sexually reproducing); No mixes in clones. <i>or</i> A small quantity of genes (but maybe often).
Traditional Breeding	Selection of desired phenotype.	Selected parents.	Selected offspring.	Massive mixes, but limited to within species boundary. Inheritable somatic mutations in some clones.
Biotech	Modification of genes within an individual (e.g., de-activation of a gene which causes disease). Cloning techniques.	None.	None.	None.
	Transfer of genes between individuals of the same species; <i>or</i> Transfer of genes between species of the same kingdom (e.g., a human gene into a cow); <i>or</i> Transfer of genes between species of different kingdoms (e.g., a fish gene into tomato plants).	Use of genes from non-sentient beings; <i>or</i> Use of genes from sentient animals; <i>or</i> Use of human genes from living humans; <i>or</i> Use of human genes from dead humans (e.g., from sperm bank). <i>Also:</i> Use of multiple donors.	Non-sentient beings; <i>or</i> Sentient animals.	A small quantity of genes; <i>or</i> Massive mixes across species boundaries: 'chimaera' (e.g., an animal that is half-sheep and half-goat by origin).

Table 2: The 'purpose-based conception of biotechnology' — a classification of existing and theoretical biologicals for environmental use based on their intended environmental effect ['MO' = microorganisms]. See Chapter 1 for details.

System	Target	Agent; Or: Source of Chemical Extract	Product Type (Living Agent)	Product Type (Dead Agent or Chemical Extract)
Any	'Abiotic' (e.g. raw oil, odours, heavy metals)	Microorganism [MO]	Agent for bioremediation	Enzymes from bioremediation agents
		Plant	Agent for phytoremediation	Perfume, "natural chemicals"
		Animal	(theoretical?)	Perfume
MO (e.g., natural community)	None	MO (same species as system)	Mushroom cultures	(theoretical?)
		Plant	Host plant in mushroom cultures (theoretical?)	(theoretical?)
		Animal	Symbiotic animal in microbial system (theoretical?)	(theoretical?)
	MO (e.g. competing strain; odour generating MO's)	MO - same species as system	Resistant strain	(theoretical?)
		MO - same species as target	Competing strain	(theoretical?)
		MO - other species than system or target	Selective antibiotic	Anti-foulant (theoretical?)
		Plant	(theoretical?)	Perfume, natural fungicide
		Animal	(theoretical?)	Perfume
	Plant	MO, Plant, or Animal	(theoretical?)	(theoretical?)
	Animal	MO, Plant, or Animal	(theoretical?)	(theoretical?)

System	Target	Agent; Or: Source of Chemical Extract	Product Type (Living Agent)	Product Type (Dead Agent or Chemical Extract)
Plant (e.g., crop; forest; native flora)	None	MO	Mycorrhiza for use in plantations, MO- treated seeds. N ₂ - fixating bacteria	Natural fertilizer, components of compost or manure
		Plant (same species as system)	Agriculture and aquaculture, forestry, gardening, landscaping. Biotech products: e.g., frost resistant plants, cloned endangered species, 'Neutraceuticals'.	Components of compost
		Animal	Pollinators, agents of dispersal	Components of manure
	MO (pathogen or symbiont of weed)	MO - same species as target	Plant vaccine (theoretical?)	Plant vaccine (theoretical?)
		MO - other species than target	Plant antibiotic (theoretical?)	Natural fungicide
		Plant - same species as system	Resistant crop	Natural fungicide (theoretical?)
		Plant - other species than system	Deterring plant	Natural fungicide; plant allelochemical
		Animal	Biocontrol agent (theoretical?)	Natural fungicide (theoretical?)
	Plant (weed)	MO	Bio-herbicide	Bio-herbicide
		Plant - same species as system	Competitive crop; herbicide-resistant plant	Natural herbicide; plant allelochemical
		Plant - same species as weed	Sterile plant technique (theoretical?)	Natural herbicide (theoretical?)
		Plant - other species than system or weed	Deterring plant; beneficial competitor	Natural herbicide; plant allelochemical
		Animal	Biocontrol agent, beneficial agent	Natural herbicide (theoretical?)

System	Target	Agent; Or: Source of Chemical Extract	Product Type (Living Agent)	Product Type (Dead Agent or Chemical Extract)
	Animal (pest)	MO	Bio-pesticide	Bio-pesticide
		Plant - same species as system	Resistant crop	Natural insecticide (theoretical?)
		Plant - other species than system	Deterring plant species	Natural insecticide; plant allelochemical
		Animal - same species as pest	Sterile male technique	Pheromones, allelochemical
		Animal - other species than pest	Biocontrol agent, beneficial agent	Allelochemical, natural insecticide
Animal (e.g., free-range livestock; wildlife; fish)	None	MO	(theoretical?)	Food additives
		Plant	Food plants	Food supplements
		Animal (same species as system)	Livestock rearing, aquaculture, game, endangered species. Biotech: transgenic livestock, cloned endangered species.	Food supplements
	MO (pathogen or symbionts of weed)	MO - same species as target	Vaccine	Vaccine
		MO - other species than target	Antibiotics	Drug
		Plant	Medicinal plant	Drug
		Animal - same species as system	Immune livestock	Drug, vaccine
		Animal - other species than system	e.g., flies that are used to clean wounds	Drug

System	Target	Agent; Or: Source of Chemical Extract	Product Type (Living Agent)	Product Type (Dead Agent or Chemical Extract)
	Plant (weed or toxic plant)	MO	Bio-herbicide	Bio-herbicide (theoretical?)
		Plant - same species as weed	Sterile plant technique (theoretical?)	Natural herbicide (theoretical?)
		Plant - other species than weed	Deterring plant; beneficial competitor	Natural herbicide; plant allelochemical
		Animal - same species as system	Adapted livestock	Drug derived from blood / tissue / immune system (theoretical?)
		Animal - other species than system	Biocontrol agent, beneficial agent	Natural herbicide (theoretical?)
	Animal (pest)	MO	Bio-pesticide (external applications)	Drug
		Plant	Medicinal plant	Natural drug
		Animal - same species than system	Immune livestock	Drug, vaccine
		Animal - same species as pest	Sterile male technique	Pheromones, allelochemicals
		Animal - other species than system or pest	Biocontrol agent	Drug

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