# Biotechnology, Biomedicine and the Precautionary Principle

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**Abstract.** The Precautionary Principle is introduced and shown to be applicable to several kinds of biotechnology, such as the agricultural production of biofuels and the release of genetically modified varieties of food-species and of medicinal species into the environment. This Principle has been accused of involving policies of Maximin. However, the crucial difference between these stances is clarified and explained. Policies of Maximin could involve abandoning experimentation, together with all forms of adventurousness, whereas the Precautionary Principle does not involve any of this, and can even mandate activism in cases where inaction is likely to generate serious or irreversible harms. But some applications of biotechnology also risk generating such harms -- or their equivalent, a reduction of future quality of life --. Thus biotechnologists need to be trained to understand the Precautionary Principle and its implications, so as to distinguish benign innovations and innovations which it would be unethical to introduce on precautionary grounds.

**Keywords:** biotechnology, biomedicine and the precautionary principle

## 1 Biotechnology, Biomedicine and the Precautionary Principle

In general terms, the Precautionary Principle declares that where there is reason to regard a substance or process as environmentally seriously or irreversibly damaging, preventive action or regulation should be undertaken despite the absence of scientific certainty. While this is not a basic principle, it gives valuable guidance and valuably supplements other ethical principles when decisions have to be taken against a background of partial uncertainty.

This principle can take stronger and weaker forms. An example of a stronger form is the London Declaration on the Protection of the North Sea (1987). This Declaration authorizes the regulation of substances ‘when there is reason to assume that certain damage or harmful effects on the living resources of the sea are likely to be caused by such substances, even where there is no scientific evidence to prove a caus-

al link between emissions and effects' (1). If such a strong principle were widely adopted, a very great deal of regulation of potentially dangerous substances and processes would be authorized. An example of a weaker form is found in the Rio Declaration (1992), which states that 'where there are threats of serious or irreversible damage lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation' (2). This is weaker because a smaller range of potential damage is recognized and because other reasons than the lack of scientific certainty might be found against regulatory action. Yet even in this weak form, the Principle has great importance, because it was adopted into international law by all the countries represented at Rio, including yours and mine, and including those to which all the large pharmaceutical companies are subject.

This being so, it is worth investigating whether the Principle applies to biotechnology in general and biomedicine in particular. Is there sometimes reason to believe that serious or irreversible damage could result from their applications? With regard to agricultural applications of biotechnology, the answer is probably 'yes', for the introduction of palm-olive plantations for biofuel production in countries such as Malaysia has often led to increases of malaria among workers and local people, as well as endangering the species of the forests replaced by the plantations. There again, the introduction of genetically modified varieties of food-species into the environment brings dangers to native species of cross-breeding and thus of the extinction of the original wild species, and of the new varieties becoming 'super-weeds' and out-competing native species, even without cross-breeding. So there is sometimes reason to believe that such introductions do serious damage, irreversible damage, or sometimes both, and this triggers the Precautionary Principle, even if there is no scientific consensus about such damage being caused.

Could any of this be relevant to biomedicines? Many medicines have been derived from the biodiversity of areas such as rain-forests, and this supplies one of the central reasons for preserving such areas. Drugs such as vinblastine, which has revolutionized the treatment of Hodgkin's lymphoma, and vincristine, which has done the same for acute childhood leukaemia(3) confer great benefits on humanity. Yet there are parallel risks affecting biomedicine to those related to biotechnology. Thus plantations of crops for biomedicinal uses could in principle harbor the same dangers as plantations for agricultural food-production; as it is, opium plantations, originally intended to produce morphine for medicinal purposes, are generating such serious social harms that in many places these crops are being destroyed. There again, the release into the environment of genetically-modified varieties of species grown to produce improved medicines could in principle harbour parallel dangers to those of agricultural biofuels, with possible problems of cross-breeding and of the introduced varieties out-competing native ones.

It does not follow that biomedicine should be abandoned. But it does follow that biotechnologists in general should be aware of the risks posed by the introduction of their own biological products, and that the same applies to practitioners of biomedicine in particular. Disregarding such dangers could involve culpable negligence, and involve responsibility, however indirect, for forms of serious or irreversible harm that

could, with foresight, have been avoided. The Precautionary Principle applies, of course, to many other human practices, such as the release of carbon dioxide and other greenhouse gases into the atmosphere, to the probable detriment of distant peoples, future generations and countless nonhuman species; taking it seriously at all levels of society, and intervening accordingly, could make a very large difference with regard to the irreversibility of our carbon footprint. But that is a matter for another occasion; here its potential applicability to biotechnology in general and biomedicine in particular is in focus, and seems to be incontrovertible.

However, the very fact that the implications of the Precautionary Principle are both large and wide in their scope has led some scientists and philosophers to question its acceptability, despite its widespread acceptance and recognition in international law. The Precautionary Principle, it is said, amounts to the Principle of Maximin, according to which agents should select the course of action among their options of which the worst outcome would be the least bad; this Principle bids us review the conceivable outcomes of our various options, and avoid all but the least risky of them (which would often be the option of doing nothing). It would therefore stultify adventurousness, enterprise and initiative, discourage experimentation (even in science, for which experimentation is pivotal), and make being cautious at all times a moral requirement.

But the Precautionary Principle does not advocate such a maximin principle or policy, for it does not focus on preventing the worst outcome that could conceivably happen, but on preventing outcomes that there is reason to consider as significant threats or dangers, ones that, as well as being of a serious or irreversible nature, are also significantly possible. While extreme risk-aversion counsels not venturing out-of-doors in case of being struck by lightning, the Precautionary Principle actually advocates bold action to prevent, for example, tidal surges and forest fires, phenomena which most people recognise (on the strength of recent trends) as likely to increase in both in magnitude and frequency because of anthropogenic climate change. Far from eradicating initiative, it can empower fearless campaigning (like that of Greenpeace) for the sake of a sustainable future, as well as assisting in discerning which policies can rationally be risked, and which cannot. It can recognize that it is often inaction that would generate serious or irreversible harm, as when coastal erosion is left unchecked or flooding is treated as beyond prevention, and that bold initiatives and reflective activism (whether in campaigning or in social policies) are the ways to avoid a drift to disaster.

So the Precautionary Principle should not be rejected on these grounds, nor misrepresented as advocacy of extreme caution. Indeed it should be applied to anti-technology campaigns as well as to technology. Thus if a genetically-modified strain of wheat or rice could rescue millions of people from starvation, without countervailing side-effects, then the Precautionary Principle tells us that inaction is what we should avoid, rather than the smaller risks attending this innovation. Yet it applies also to technological innovations as well as to campaigns of protest, and we should not be distracted from adhering to it through caricatures such as its misrepresentation as a policy of caution and extreme risk-aversion.

Besides, its scope may well be greater than at first appears. Some philosophers have pointed out that it is not possible to damage or harm most future people or creatures of other kinds, because harm is only possible where there is an alternative, but that many future individuals would only exist in one possible world or future scenario, and that different policies adopted in the present would generate different future populations, rather than the same people but without damage or harm. So if the Principle concerns damage or harm, it applies only to individuals already alive or conceived, since their successors cannot strictly speaking be harmed or damaged at all.

However, the philosopher who has reflected on these matters most penetratingly, Derek Parfit (4), also holds that our responsibilities are not restricted to avoidance of harm to existing individuals. For through actions such as the policies we adopt we can often enhance the quality of life of whoever is alive in the future, meaning by this whichever population happens to occupy our continent or the planet in future times. Thus we could avoid them suffering the impacts of high increases in average temperatures, and we could make provision for them to inherit remedies for serious diseases; and where we can enhance the quality of future lives, we have the same responsibility as for avoiding harm to identifiable people in the present, even though we cannot know which future people will stand to benefit from present action. Parfit supports these claims through a series of thought-experiments, and shows thereby that most of us presuppose that present action that foreseeably deprives future people of resources or significant opportunities is just as unacceptable as harming people in the present. It is true that our ability to know the impacts of present action on future people is sometimes a problem. But we hardly doubt that future people will need a healthy and life-supporting natural and social environment, and this already shows that the problem of grasping future needs can sometimes be overcome.

Parfit's claim amounts to acceptance that the Precautionary Principle applies to future impacts as well as present ones. Avoidance of serious or irreversible harm should be treated as including avoidance of serious or irreversible reductions in quality of life, both for future human and future nonhuman generations. Many people assume that it includes all this in any case, but it is wise to spell this out, in view of significant scepticism in some quarters on the part of people who seriously suggest that we have no responsibilities with regard to individuals who cannot yet be identified. For those who do not assume this, the implications of the Precautionary Principle turn out to be even ampler than they are often taken to be, but no less credible nonetheless.

It is thus highly important that biotechnologists, including practitioners of biomedicine, should study the Precautionary Principle and its implications for their various fields of practice. I was appalled to discover that genetics students of my own University had never heard of it, even though they were being trained to introduce into the world genetic innovations, whether for the sake of medicine or of practices such as agriculture, and attempted to ensure that my teaching of ethics would put this right. The same applies to many other forms of biotechnology and to their practitioners, such as those working on biofuels, and indeed to students of biotechnology in

general. College and University syllabuses should be modified so that all such students learn of and reflect on the Precautionary Principle.

This is not said with a view to an overall curtailment of the application of biotechnology. As we have seen, some of its applications are benign, while the introduction of some is probably a positive duty. There are, however, other applications that fall foul of the Precautionary Principle, which (at least in its stronger forms) authorises preventive action, and (even in its weaker forms) declares that absence of a scientific consensus is no reason in itself against such action, even if, possibly, there are other reasons. But one of these weaker forms is a version of the Precautionary Principle to which all the world's governments except those of states that have begun to exist since 1992 are already committed. Governments of signatory states should accordingly take action to embody study of the Precautionary Principle into the syllabuses of all their students of science and technology, for in the absence of such measures, avoidable serious or irreversible harm and avoidable serious or irreversible quality of future life are all too likely to occur. Everyone concerned with present and/or with future quality of life should do what they can to achieve this change of educational policy both internationally and in their own country.

## REFERENCES


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