

Antarctic bioprospecting, benefit sharing and cooperation in Antarctic science

Antarctic ecosystems consist of diverse communities of organisms uniquely adapted to their extreme environment. One of the drivers of Antarctic science is to investigate this rich biodiversity. There is little doubt that knowledge of Antarctic biodiversity benefits humankind, because it allows us to better understand the world we live in and to make informed decisions about the future. It also offers other important benefits to society, not the least of which is the development of new medicines to treat human disease. Many of the unique chemicals produced by living organisms to assist them in their daily battle for survival also have valuable pharmaceutical properties. The process of tapping into the world's natural biological resources for healthcare and other purposes is known as bioprospecting. This process is also sometimes referred to as biodecovery – at least at the early stage of exploration and initial sample collection.

The potential for research on Antarctic organisms to contribute to the public good is well demonstrated by the following extract from a patent claiming an enzyme derived from krill and fish. The patent claims that this enzyme is useful in the treatment of:

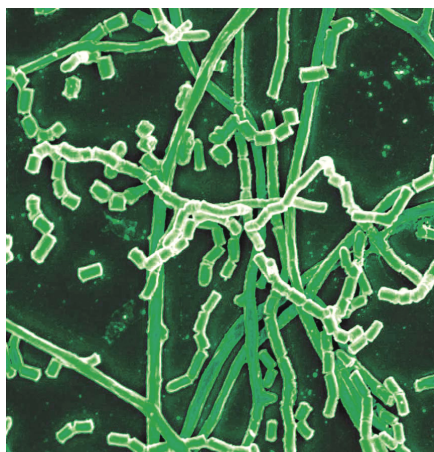
viral infections such as herpes outbreaks, fungal, bacterial or parasitic infections, including the primary and secondary infections of leprosy, colitis, ulcers, haemorrhoids, corneal scarring, dental plaque, acne, cystic fibrosis, blood clots, wounds, immune disorders including autoimmune disease and cancer.

Patents such as this are the lifeblood of the biotechnology and pharmaceutical industries. A patent gives its owner, and anyone else who the owner permits, the right to use the invention for the life of the patent (usually 20 years) and to exclude others from using it. The trade-off to society is that the patent owner has to disclose the invention and the best method of performing it. The patent owner gets the benefit of a period of time when they are free from competitors in the market. But once the patent expires others are free to use the invention.

The main argument justifying patents is that they encourage innovation: they provide the necessary incentive for patent holders to invest significant time and money in bringing their inventions to market. If a blockbuster drug results then the patent owner receives a windfall. However, there are many pitfalls on the long and winding road to market. For drugs, the usual figure for time from invention to market is 12-15 years and the estimated cost is \$500-800 million, with only one in 5000 products actually making it to market. Hence, we can perhaps take it as read that, if we want new medicines, we have to have patents

(although it must be acknowledged that some would, nevertheless, argue to the contrary). These costs of drug discovery do not even take account of the early pre-invention phase. For medicines based on natural products, samples have to be collected, isolated, characterised, and screened for pharmaceutical activity before drug-related patents can be filed. Each of these steps is expensive and risky and requires considerable skill.

Despite these potential pitfalls on the road to product development, the importance of bioprospecting in the process of drug discovery is



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False-colour scanning electron microscope image of Nocardia spp. showing the filamentous nature of hyphae breaking into individual cells. These bacteria were isolated from Antarctic soil. The great diversity of Antarctic bacteria is seen as having enormous biotechnology potential.

widely acknowledged and there is general support in industrialised countries for the development of a bioprospecting industry. The Convention on Biological Diversity (CBD) recognises, on the one hand, the enormous public benefit to be had from exploitation of natural resources and, on the other hand, the sovereign rights of countries to control access to their resources and to share in the benefits from their exploitation. The CBD and the associated Bonn Guidelines set up a system for facilitating and regulating bioprospecting by providing guidance to countries on how to deal with the three key issues of access, benefit sharing and technology transfer. The goal is not only to provide appropriate incentives for innovation, but also to acknowledge the sovereign rights of owners of natural resources to control access and share profits and technological developments.

What, then, of bioprospecting and patenting in the Antarctic? Some important points need to be made.

1. The underlying philosophy of the Antarctic Treaty System is that the region should be dedicated to cooperative scientific research. This is reflected in Article II of the Treaty, which pro-

vides for freedom of scientific research and Article III, which provides for exchange of observations and results.

2. Various forms of commercial activity are well established in the Antarctic and bioprospecting research has been underway in the Antarctic for decades. The patent referred to earlier is but one example out of many that make claims to products derived from Antarctic natural resources.

3. Two of the major concerns associated with exploitation of Antarctic resources, namely over-harvesting and environmental impact, are probably not relevant when considering collection for bioprospecting purposes. At the early biodecovery stage sample sizes are small (as little as a teaspoonful of Antarctic soil). Once a chemical with potential medicinal properties has been isolated it may be necessary to collect larger quantities for proof of concept, but, after that, ideally the chemical should be capable of synthetic manufacture in the laboratory. Significant impacts would only be an issue if synthetic production were not possible and large scale harvesting from the wild was required. Hence, bioprospecting could be seen as an acceptable industry for Antarctica: potential benefit for society, with minimal potential cost to the Antarctic environment.

4. From the economic perspective, the risky and costly business of drug development is further exacerbated if the cost of collection trips to the Antarctic is factored in. However, research expeditions to Antarctica are generally publicly funded. There are a limited number of people undertaking activities in the Antarctic providing good capacity to monitor their activities. The return from bioprospecting could result in increased funding for basic Antarctic research.

5. The normal mechanisms for ensuring benefit sharing from exploitation of biodiversity (the CBD and the associated Bonn Guidelines), which are founded on recognition of sovereign rights over natural resources may be difficult to apply in the Antarctic. At the same time, the Antarctic Treaty System has not established a regime for regulating an emergent Antarctic bioprospecting industry.

6. For this reason, the Treaty parties have begun to consider the issue of what, if any, regulatory requirements should be put in place in relation to Antarctic bioprospecting. There are various precedents that might provide assistance, including the CBD/Bonn Guidelines, the International Treaty on Plant Genetic Resources for Food and Agriculture, and the Law of the Sea in its application to the deep sea bed. However, it must be remembered that it may be many years before any of the profits of Antarctic bioprospecting are realised, if at all.



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David Nichols and John Grey in Ellis Fjord, Vestfold Hills, collecting sea ice cores to isolate bacteria. Sea ice is a rich source of bacteria with unusual chemicals required to thrive in this harsh environment.

7. Antarctic bioprospecting does not only raise issues in relation to benefit sharing; it also has important consequences for Antarctic scientific research. The Treaty Parties will need to consider the implications, if any, for the exchange of information and scientific results. It is inevitable that once promising drug precursors are found they

will be the subjects of patents. This makes sound commercial sense. Of themselves, these patents may not impinge too greatly on freedom of scientific research, provided that they only claim rights over pharmaceutical applications and do not extend more broadly, making claim to such things as isolated gene sequences and proteins.

However, freedom of scientific research and exchange of observations and results may be further constrained by confidentiality and non-publication obligations required by commercial partners. A certain level of confidentiality is required to ensure that the novelty of any downstream patent applications is not compromised. But if these obligations are cast too broadly, they may have serious impact on the philosophy of free exchange of scientific observations and results. If necessary, a balance may need to be found between the interests of bioprospectors in protecting their patent rights and of researchers in protecting their freedom to publish their results, to make their materials available and to discuss their ideas with colleagues around the world.

In conclusion, bioprospecting offers great promise as a clean, green Antarctic industry. At the same time it is necessary to maintain the spirit of cooperation that is so much a feature of Antarctic science. As commercial interest in Antarctic bioprospecting develops, we will watch with interest the policy response developed by the Antarctic Treaty.

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Will tourism change how we manage Antarctica?

From the beginnings of the Antarctic tourism industry in the 1950s the management of tourism and non-Governmental activities in the Antarctic Treaty area has been based on cooperation between the tourism industry and Antarctic Treaty Parties. Following establishment of an industry body, the International Association of Antarctica Tour Operators (IAATO) in 1991, the relationship with tour operators strengthened – IAATO has been invited to send representatives to Antarctic Treaty Consultative Meetings (ATCM) as invited experts. Since that time the ATCM and IAATO have continued to work together on the management of tourism activities in Antarctica. This collaboration has led to the development of guidelines and operating procedures that aim to minimise the environmental impacts of tourism, as well as promoting the conduct of safe and sustainable tourism activities.

Over the past decade there has been significant growth in the Antarctic tourism industry with increasing diversity in the activities being undertaken, and a rise in the number of tourists and the localities being visited. In 1992–93 there were only 6,704 tourists that landed in Antarctica compared to 13,263 in 2002–03. IAATO estimates that the total number of tourists visiting increased to 17,547 in 2003–04. The range of ship-based activities has expanded similarly, with activities in recent years including

marathon runs, camping, kayaking and scuba diving.

The increase in the diversity and size of the tourism industry, together with concerns relating to the practical management of adventure tourism, has resulted in the ATCM reviewing how tourism activities are managed. During recent meetings the Treaty Parties have held detailed discussions on a wide range of issues related to the management of tourism. These issues have included:

- adoption of an accreditation scheme;
- development of coordinated environmental monitoring schemes at tourist sites;
- development of activity and site specific guidelines;
- the requirement for safety regulations and insurance;
- creation of a centralised database on non-government activities;
- self-management of the industry;
- adoption of an on-board observer scheme;
- development of navigational guides for yacht operators;
- development of an Antarctic polar shipping code; and
- production of educational material for tourists.

The XXVI ATCM in 2003 decided to convene a Meeting of Experts to consider some of these issues in more detail prior to the XXVII



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ATCM. The Parties accepted the offer of the Norwegian Government to host the meeting in Norway from 22–25 March 2004.

The Meeting of Experts considered the following topics relevant to the issue of tourism and non-governmental activities in Antarctica:

- development of an accreditation scheme;
- monitoring, cumulative impact and environmental impact assessment;
- safety and self-sufficiency, including search and rescue and insurance;
- jurisdiction, industry self-regulation, and an analysis of the existing legal framework;
- guidelines;
- adventure (extreme) tourism and government sponsored tourism; and
- coordination amongst national operators.

These discussions will lay the groundwork for decisions to be made at future Treaty meetings.

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