INTRODUCTION

The medicinal use of rainforest products has an extensive history dating back to the 17th century when Quinine, a cure for malaria derived from the bark of a cinchona tree, was exported to Europe. In the United States, 25% of prescription drugs have an active ingredient derived from a plant (Reid 1996: 145). Thus, the sheer biodiversity of the rainforest represents a huge resource of potential pharmaceuticals, particularly in light of the fact that rational drug design is currently limited in the complexity of molecules that can be synthesized (Onaga 2001).

Pharmaceutical research in the Amazon is only feasible if the biodiversity of the ecosystem is maintained, as any reduction reduces the number of compounds that can be tested for biological activity. As of 1985, approximately 75% of plant-based drugs had been discovered from follow-up studies on plants used by indigenous peoples in traditional medicine (Farnsworth 1985: 986). Thus, pharmaceutical research incorporates indigenous communities by utilizing their Traditional Ecological Knowledge (Posey 2000: 191) and local development and conservation could theoretically follow as a by-product of commercialization of pharmaceuticals. This paper will examine the merits of pharmaceutical research as an Integrated Conservation and Development Project (ICDP), with particular reference to the International Cooperative Biodiversity Group (ICBG) program.
HYPOTHESES

This paper is subject to two potentially falsifiable hypotheses:

1. Pharmaceutical research in the Amazon has not adequately contributed to conservation, in part due to a lack of incentives as well as the lag time between research and economic return.

2. The benefits of such pharmaceutical research can outweigh the extensive research costs with greater incentives to invest in projects and increased benefits for local people. However, it is not economically viable as a large-scale conservation and development solution.

AN OVERVIEW OF THE ICBG PROGRAM IN PERU

The ICBG funds programs worldwide and is run by several U.S. government agencies, including the NIH, NSF and USDA. According to the program website, the goals of the program are to “integrate improvement of human health through drug discovery, creation of incentives for conservation of biodiversity, and promotion of scientific research and sustainable economic activity that focuses on environment, health, equity and democracy” (www.icbg.org). The public-private partnerships characteristic of ICBP projects provides a way to integrate economic development and scholarly research. With Dr. Walter Lewis as the principle director, Washington University received an ICBG grant from 1994-2000 to research “Peruvian Medicinal Plant Sources of New Pharmaceuticals” (Lewis 2007:7). The original project involved a partnership with two Peruvian Universities, Universidad Peruana Cayetano Heredia (UPCH) and Universidad Nacional Mayor de San Marcos, Museo de Historia Natural (USM), and the pharmaceutical company G.D. Searle and Co.
THE ANDEAN TROPICAL RAINFOREST & INDIGENOUS COMMUNITIES

The Peru ICBG program was carried out in the northeastern lowland Andes rainforest of Peru through collaboration with Aguaruana indigenous communities of the region (Fig 1). The tropical Andes have a high diversity of woody plants, which makes this area very attractive for ethnobotany research. It is also characterized as a biodiversity hotspot and is thus of particular interest for conservation measures (Conservation International).

The Aguaruna people belong to the Jivaro linguistic family and live in over 140 independent communities (Aponte 2009: 524). These communities maintain similar oral traditions that incorporate their collective knowledge of medicinal plants (Lewis 1999). In ICBG negotiations, the Aguaruna people were represented by a national-level organization, the Confederation of Amazonian Nationalities of Peru (CONAP) and it is estimated that only 50% of the indigenous communities in the region were involved in the agreement (Cook 2001: 91).

SUCCESSES OF THE PERU ICBB PROGRAM

The structure of the agreement between all of the groups involved was very complex (Fig 2), but the unique feature of these contracts and the license that will be the focus of this paper is that between CONAP and Searle Co. This know-how license involved Searle paying $30,000 in annual licensing and collecting fees to the Aguaruna people in exchange for their
knowledge of medicinal plants. The right was non-exclusive and non-transferable, so the Aguaruna maintained ownership over their knowledge and the right to make agreements with other organizations (Cook 2001: 93). The agreement also involved payments throughout drug development and royalties for any products (Lewis 2007:12). The Aguaruna president of CONAP and two lawyers from the organization negotiated the contract without any involvement from Washington University (Greene 2004: 127). As a result, this was the first such direct agreement between a pharmaceutical company and indigenous group and represents an acknowledgement of indigenous rights that had not yet been seen (Rosenthal 1997). Though intellectual property rights are very difficult to negotiate, these conditions are an attempt at a relatively equitable partnership between a corporation and an indigenous community and the direct communication between the two represents a success of the ICBG model.

A second success of the ICBG program in Peru was the capacity building in the host country. This generally involved the transfer of technology and training to the local universities. Students at the Peruvian universities and members of the indigenous communities received training in field research and plant collection. Two members of the Aguaruna community even led their own successful field expedition by the end of the project (Lewis 1999). Among other benefits, the museum also received a set of plant and animal samples, providing an inventory of biodiversity in the region (Cook 2001:97). This is an important resource for future conservation research and also publicizes the host institution. The direct participation of the local universities
in the research served to empower these institutions and increase their capacity to conduct further projects, an important aspect of an ICDP.

A final success of the ICBG program was the screening of plant compounds for biological activity. Though no blockbuster drug has been produced to date, research is still ongoing on potential leads. Recent efforts have focused on potential sources of anticancer, anti-infective, and would healing agents from collected samples (Aponte 2009: 524). This biological activity detected in some plants for the first time indicates the possibility of further bioprospecting in the future. Beyond this, in 2002 a shared provisional patent for compounds with possible anti-malaria properties was awarded to the four organizations involved (excluding Searle & Co.). This is the first example of a joint patent involving an indigenous group in Latin America (Lewis 2007: 15), emphasizing a step forward in indigenous rights integrated with improving human health. However, no drugs based on this patent have been developed so far.

WEAKNESSES OF THE PERU ICBG PROGRAM

The concept of the ICBG program is sound, but it is not without significant problems. The negotiations took two years and corporations may not be willing to wait so long before investing in the project (Cook 2001: 112). Furthermore, not all Aguaruna communities were represented in the agreements and these groups therefore did not receive any of the project benefits, despite having the same body of medicinal knowledge. Not only is this not equitable, but it also reduces the conservation impact since uninvolved groups have no incentive to preserve the biodiversity.
In total, the five-year ICBG program likely cost $2.2 million and the Peruvian stakeholders received approximately $1.1 million (Cook 2001: 112), while the indigenous groups likely received $55,000 annually (Cook 2001: 100). Thus, the monetary compensation is minimal in comparison to the economic return that is possible from utilizing more destructive forms of development, particularly once the money is divided among participating communities. Unless the benefits received for maintaining the forest are greater than the benefits of deforestation, there is no incentive for conservation. Furthermore, pharmaceutical research does not directly influence conservation, which prevents this project from fully succeeding as ICDP. The benefits received are immediate (in the form of licensing fees), and the future promise of royalties of any drugs developed (Rosenthal 1997). However, there is no incentive to maintain biodiversity in the interim time.

This high-risk nature of pharmaceutical research is another key weakness of the ICBG program. Since no blockbuster drugs were produced, the only monetary benefit to the indigenous peoples was in the upfront payments and licensing fees. For this reason, the host countries involved in ICBG programs have often been disappointed with the lack of success of drug discovery endeavors (Rosenthal 1999). The uncertainty of this research also limits pharmaceutical company interest. The participation of such corporations is important for financial backing, research capabilities, and the licensing of any products. However, the extensive lagtime between the original research and any profits makes drug development costs high without a guarantee of economic return. Searle did not renew its license with the Aguaruna organizations, cited that the relationship had not been cost effective (Carneiro Dias 2007: 112).

THE FAILURE OF SHAMAN PHARMACEUTICALS
Searle’s exit from the ICBG program echoes a similar problem encountered by Shaman Pharmaceuticals, a South San Francisco company that went bankrupt in 2001. Shaman Pharmaceutical’s business model seemed promising for future bioprospecting endeavors: the company developed drugs based on traditional medicines and then directly benefited those communities through the Healing Forest Conservancy nonprofit. The use of indigenous knowledge was meant to maximize drug production efficiency and reduce costs (Conte 1996: 97). However, though many various factors contributed to the company’s failure, the same time and monetary constraints that led to Searle’s exit from the ICBG program played a role here. The FDA did not approve Shaman Pharmaceutical’s Provir drug, which was supposed to relieve diarrhea from AIDS (Abate 1999). The delay on this drug made the product unattractive to investors and Shaman Pharmaceutical did not have sufficient funds to continue. Though the ICBG program is similar to Shaman Pharmaceuticals in methods and goals, the ICBG program differs in that it is a public-private partnership rather than a company, reducing some of the project’s financial risk. However, monetary constraints nevertheless limited the project’s output (both in products and benefits) and must be addressed in future bioprospecting endeavors.

CONCLUSIONS & RECOMMENDATIONS

The most significant problems of the Peru ICBG program are a result of the high-risk nature of pharmaceutical research and the lack of direct incentives for conservation. Thus, these issues are the two that should be immediately addressed for future models of pharmaceutical research as an ICDP.

Though the public-private partnerships of the ICBG are a step in the right direction, more
government resources are necessary to diffuse the risk of pharmaceutical companies and increase benefits to local communities. Government subsidies have often made industries profitable when they otherwise would not be economically viable and such subsidies would greatly benefit pharmaceutical ICDP projects. There is a strong argument for increasing government incentives as the program is meant to benefit human health worldwide in addition to providing host countries with the means improve infrastructure. There is also the potential for the industry to become profitable through drug discovery, but only if pharmaceutical companies can be encouraged to remain involved in projects for a longer period of time.

The implementation of such government subsidies could raise controversies in where the money originates and over the sovereignty of host countries. However, the ICBG program award from the U.S. can be viewed as a small-scale model for future endeavors. The project was a government investment in the industry, but it just did not provide enough resources. Furthermore, the active inclusion of host country organizations, as seen in the ICBG program, allows host countries to maintain partial control. Subsidies should originate from the countries investing in these bioprospecting projects. For example, in the case of the ICBG program, it was a U.S. company and a U.S. financial award. The public-private partnership of the ICBG program remains its greatest success and is an essential part of future bioprospecting projects.

The capacity building in host countries is also essential to the success of pharmaceutical research as an ICDP, as are monetary payments for services and licensing agreements with indigenous communities. However, as seen here, these benefits are not enough to incentivize conservation. The benefits, in the form of healthcare, economic opportunity, and infrastructure, must be significant, but education must also be incorporated so that communities understand that
the benefits are a direct result of conserving the forest. Education is a powerful tool to establish the link to conservation that is currently preventing pharmaceutical research from succeeding as ICDP. Host country universities should ideally implement such education as they successfully played a prominent role in this ICBG project. Without education, local communities are likely to turn to more profitable destructive uses of the forest. Benefits should also incorporate all indigenous communities that share the traditional knowledge. Admittedly, such programs, as any western contact, will alter indigenous communities. However, the communities’ prior informed consent represents a certain amount of assimilation that has already occurred.

Even with these changes, pharmaceutical research is only part of a conservation and development solution. It ignores the extensive non-indigenous communities that live on the fridges of the forest and contribute to deforestation. Furthermore, its primary successes have been to improve community development and (potentially) health, rather than economic development. Thus, while these benefits can still make pharmaceutical conservation worthwhile, a reevaluation of goals is necessary because, as exemplified here, profit cannot be guaranteed. Nevertheless, most synthetic drugs fail as well and one marketable drug could change the industry’s outlook.
The ICBG program successfully pioneered public-private partnerships and indigenous agreements in pharmaceutical research and, particularly through the know-how license, helped establish indigenous rights. Though this program does not adequately serve as an ICDP due to the high-risk nature of pharmaceutical investment and lack of conservation incentives, increased subsidies in addition to local benefits and education would improve this. Bioprospecting cannot be expected to succeed economically without public investment, but the dual conservation and development benefits could outweigh these costs if the necessary improvements are made.

WORKS CITED


Onaga, L. (2001). Cashing in on nature’s pharmacy. EMBO reports 2, 263-265


