

# ***Robotic Technology: Malaysia***

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## **Summary**

The island of Borneo is home to many diverse ethnic communities, each with its own unique way of life for which traditional medicines and cures play an important part. These therapies have been around for far longer than modern medical practices and are so well-rooted in local culture that even today when modern medicines are widely available throughout the island, traditional cures and treatments continue to be used instead of, or alongside, the newcomers.

Borneo is politically divided between Malaysia and Indonesia. This project concerns the provinces of Sabah and Sarawak, which are part of Malaysia.

Plants and plant materials are important elements in the island's ancient medical systems. About 1,000 of the plant species that grow in Borneo's forests are already known to be useful for the treatment of a plethora of diseases and conditions. These 1,000 species are obviously the first port of call for any systematic study of medicinal plants. However, given that they represent only 10 percent of the total number of species found in Borneo's forests, there is a good chance that scientific research and technology will eventually be able to identify many other valuable plants. This is particularly exciting in terms of the potential for socio-economic development because, while many of these plants are endemic to Borneo, scientists and pharmaceutical companies throughout the developed and developing worlds are turning more and more to tropical plants and traditional medicines in their hunt for new ways of tackling illnesses, including emerging such diseases as cancer and AIDS.

At the same time, however, deforestation and other human activities are causing the rapid destruction and disappearance of natural habitats and pushing many medicinal plant species to the brink of extinction. Thus there is an urgent need to carry out detailed studies of Borneo's plants and their medically useful properties before it is too late. Logging operations, for example, are damaging between 30 and 70 percent of the surviving forests and, if conservation efforts are not intensified, an alarming number of plant species are likely to die out forever.

In 1993, the University of Malaysia at Sarawak (UNIMAS) launched a long-term, multi-disciplinary study of the medicinal plants used by Borneo's ethnic groups. The main objective of this ongoing study has been to preserve traditional medical materials and knowledge by protecting both from the pressures inflicted by modern medical beliefs and modern industrial activities and by ensuring that their raw plant ingredients do not disappear. The best way to make sure that this happens is to find ways of making the knowledge and plants useful to the modern world.

As well as documenting existing plant products and their known uses, UNIMAS collaborates with a Japanese pharmaceutical company on a drug discovery programme to develop and test new medicines. The programme uses a method called high-throughput (HTP) screening that is based on robotic technology and capable of screening more than a million samples a year. Such robotic technology is expensive to install and maintain. As a result, it is only useful when very large numbers of samples are available for testing. That makes the partnership — between resource-rich Malaysia (with its 10,000 plant species in Borneo alone) and technology-rich Japan — the ideal solution.

## **Background and Justification**

According to the World Health Organization (WHO), as much as 80 percent of the world's population depends, at least in part, on traditional medicines for primary health care needs. Most of these medicines are in the form of plant taken from plant parts.

Modern medicines also make wide use of natural products. Worldwide, about 40 percent of the conventional drugs that are commonly prescribed are prepared directly or indirectly from plant or animal products, including several that mitigate life-threatening illnesses.

Existing plant resources and traditional practices must be protected and expanded before forest depletion leads not only to the loss of valuable species but to the loss of valuable, indigenous knowledge as the people who hold that knowledge are displaced to other areas where the plants cannot be found and used and their traditional medical skills are rendered useless in light of the circumstances in which they live.

Borneo is a good source of both plants and knowledge because its well-established traditional practices have survived the onslaught of modernization as a result of several factors:

- Many of the island's ethnic communities are remote and have only limited access to government-provided modern health facilities.
- Traditional cures are readily available and low in cost.
- Cures are part of local culture and people accept them more readily than imported drugs, especially for psychological and spiritual conditions.

Elsewhere, concerns about side-effects and loss of faith in modern techniques for the treatment of many (again often psychological and spiritual) ailments are encouraging people in developed countries to turn to folk cures from less industrialized countries as viable alternatives, especially because of the more holistic attitude to health that many ancient systems take.

UNIMAS research efforts embrace a two-pronged approach that integrates: Recording of local traditional knowledge and use of medicinal plants with high-technology screening (HTP) procedures. The first of these efforts seeks to make the most of what Borneo's indigenous peoples have discovered over the centuries; the second tests the potential for discovering new modern drugs based on the island's rich natural resources.

HTP screening basically tests the effectiveness of substances from various sources for controlling, curing and preventing a wide range of diseases and ailments. In the project, the medicinal plants that communities know and use are collected. The chemical extracts obtained from them are then screened to disclose scientific explanations for why the extracts work against the diseases they are used to treat. HTP allows thousands of extracts to be screened in a matter of days.

The project addresses several key issues:

- Documentation of the medical plants used in Borneo before the displacement of communities causes indigenous knowledge (previously passed from generation to generation) to be lost forever.
- Scientific analyses to confirm that the plant extracts and active ingredients used really do cure the ailments they are used to treat.
- Protection of intellectual property rights (IPR) to ensure all the benefits are equitably and appropriately shared when local natural resources from developing countries are used to develop and manufacture new drugs in developed countries.
- Identification and protection of the habitats and localities in which medicinal plants grow to maintain abundant supplies.
- Guidelines for medicinal plant research involving successful partnerships between the developing countries where the plants grow and developed countries with the necessary technology for effective, scientifically verified drug discovery research.

## **Description**

Any effort to find new drugs must involve people and techniques from different disciplines. The first step is to decide which plants are worth investigating — that is, which are likely to have some real medical value.

There are many ways of achieving this goal. Researchers can take a random approach to plant selection; or, they can limit their search to plants of a certain species or genus (the taxonomic approach), plants that contain specific chemicals (the chemotaxonomic approach), or plants that are already known as traditional medical cures (the ethnobotanical approach).

At UNIMAS the ethnobotanical approach was relied on to identify plants that had long been used to treat specific ailments and diseases. This tactic focused on building a bank of samples large enough to make HTP screening worthwhile. At the same time, random collection of microbes, plant and animal materials was also carried out.

Researchers began by visiting remote communities and interviewing local medical practitioners, plant collectors and other knowledgeable people to collect and document as much oral and written traditional knowledge of the medicinal uses of plants as possible. They gathered plants from the forests and herb gardens nearby each community and took these samples back to the laboratory where crude extracts were prepared.

Next, the details of thousands of these samples and their bioactive activities (the effects that they have on other organisms, especially humans in this case) were recorded on a computerized extract bank and kept for HTP screening to determine how they could be used against various diseases. Plants with useful bioactive activities (for example, medical properties) were regarded as “hits” that could become the basis for new drugs. These were subsequently subjected to in-depth investigations to isolate and identify the individual chemicals (the active principles) responsible for the beneficial effects.

Among the ailments for which the project team found existing plant-based cures were skin diseases and fungal infections, cuts and wounds, hypertension and diabetes, dysentery, malaria, fever, coughs and asthma, sore throats, lethargy, diarrhoea and gastric ulcers, loss of appetite, lice and tape-worms, insect and animal bites, muscle pain and rheumatism, and allergies.

Traditional ways of using the plants include boiling the roots, stems or the whole plant to make a tea to drink or a lotion to apply to the body; bathing in the steam from boiling plant parts; eating the fruits, drinking their juice or mixing them with water as a drink; pounding leaves, fruit and/or other parts of the plant to make a paste to apply to the body; steeping plant parts in water for drinking or bathing; cooking the leaves as a vegetable; and pulverizing plant parts and making a paste to mix with water as a drink.

Researchers found that some ailments are treated with the same plants in many different ethnic communities. This is not surprising as some plants grow all over Borneo and have active principles that are only effective against one particular ailment — for example, *Cassia alata* is widely used by many ethnic groups in the treatment of ringworm and other similar skin diseases. In other cases, however, different ethnic groups use different plant species to treat the same ailment. This takes place because the plants used by one group are not readily available to another who, instead, has some alternative with similar active principles near at hand. Malaria, for example, is treated by at least three different groups of plants at different locations.

There are also cases where the same plant is used by different communities to treat different ailments — for example, *Jatropha curcus* is used by some groups to treat cuts and wounds, by others to treat stomach aches, and still others to treat headaches. *Urena lobata*, meanwhile, is used for the treatment of influenza or dysentery, depending on the community. These plants seemingly have several different active principles, each effective against different ailments.

## Partnerships

A research partnership was forged between UNIMAS and a pharmaceutical company in Japan under which UNIMAS develops a bank of plant extracts for investigation and the Japanese company carries out HTP screening using robotics in Japan.

## Replicability

In any joint venture between a developed and a developing country, it is important that the developing country share in the benefits of the findings. In this case, plant samples that UNIMAS collected were systematically coded before they were sent to the company that for screening.

The coding made it clear where the plants came from but disguised the identity of the materials so that only UNIMAS knew exactly what they were and could not be bypassed in subsequent developments. This means that, when the hit extracts are investigated, it will be easier to draw up clear and binding agreements between the two partners about who is responsible for what and how to divide the “spoils” of research — in other words, how the economic and other benefits of any new drugs derived from

UNIMAS materials should be shared between the partners. Issues that need to be tackled include intellectual property rights related to new plant products, product royalties and the guarantee of raw material supplies.

### **Lessons Learned**

Research scientists and policymakers in Malaysia were cautious and suspicious when they heard about the partnership between UNIMAS and a Japanese pharmaceutical company. Such partnerships often have ended up with the developed country industry winning all the advantages of the new development while the developing country supplies low-cost raw materials and reaps little real profit. This fear can be allayed by making sure that there are clear, enforceable agreements that recognize the developing country as owning the original knowledge of the drug's active ingredient as well as the source of supplies. The UNIMAS coding of plant materials was a good way of achieving this goal.

The collaboration that UNIMAS has worked out with its partner is attracting great attention both at home in Malaysia and in other developing countries as a model for future joint ventures between developed and developing countries.

### **Impact**

The use of HTP screening of traditional medicinal plants is likely to have a long-lasting and profound positive impact on the sustainable use of biodiversity in Malaysia. Thanks to the screening, it will be possible to discover vast numbers of new plant and other natural products that have the potential for use in modern medicines and thus prove to be of socio-economic value to Malaysia. In addition, when the people of Borneo see the commercial and social value of their forests' natural resources they will be more likely to conserve those resources and protect their island's rich biodiversity.

### **Future Plans**

It is too early in the project to assess the benefits derived in terms of cost-effectiveness, training, capacity building and technology transfer. However, even at this stage, it seems likely that the partnership model used for this project will become mandatory for all future drug discovery programmes involving partnerships between large pharmaceutical companies and developing countries.

### **Implementing Institution**

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