

Biodiversity uncovered

The world is becoming increasingly aware of the importance of exploring the biodiversity of rainforests and of preserving traditional medical knowledge for developing new drugs.

Nuruz Zaman and Michael Heinrich explain

According to the World Health Organization, for 75-90% of the rural populations of the world, the local herbalist and other traditional healers are the only source of medical care.^{w1} This translates into three billion people for whom medical care consists of wild harvested medicines provided by local traditional healers.

Even considering these facts as an eye opener, what's possibly more startling is that many of the drugs that clinical medicine is so familiar with were in fact discovered from the herbal remedies of those indigenous people across the world. Well established drugs, such as aspirin, codeine, and quinine, were all developed from plants used medicinally for centuries by various civilisations.

Of the approximately 265 000 flowering species of plants on the planet, less than 1% have been studied in any detail to the point of understanding their composition and medicinal value.^{w2} About half of all plant biodiversity exists in primary rainforests, like the Amazon. But with deforestation and the rapid cultural and linguistic changes happening around the world, we are not only losing the vast resources of the forests but also the knowledge of the indigenous people. This is a catastrophic destruction, similar to the burning of the great libraries of Alexandria or Baghdad, in historic terms.

The pharmaceutical industry must, therefore, be able to work effectively with local people to present an alternative sustainable economic model to enrich our technological medicine and also to preserve the historical knowledge and the wealth of the rainforests in the long term.^{w3}

The interest in ethnopharmacological research has had a chequered history. Large drug companies had a considerable interest in it during the 1990s but moved to other groups of compounds in the first years of the new millennium. Recently, a renewed interest in natural products and their sources has become apparent.^{w4} As well as from technological improvements, modern laboratory techniques, and enhanced understanding of pharmacological targets,^{w5} the impetus has

come from the continual deforestation. Recent studies and publications about ethnopharmacology have stimulated many lines of interdisciplinary research.^{w5 w6}

A key factor in the long term successful relationship between traditional cultures and global drug companies involves the protection of intellectual property rights, and, in particular, the group's traditional knowledge, to prevent the threat of exploitation and to protect the interests of the healers and their communities. Increasing demands are apparent among researchers within indigenous cultures.^{w8 w9} In the development of the candidate drug prostratin, the National Cancer Institute and Brigham Young University have guaranteed that, in case of a successful development, a considerable proportion of any royalties earned by the drug would be returned to the Somoan people who are the traditional keepers of this knowledge. To many cultures, protecting the forests around them is at least as important as the future potential of receiving any money, however.^{w2}

An example of biodiversity driven drug discovery activities is provided by the US company Merck Sharp and Dome, which, for many decades, successfully used natural products in its search for new drug leads (potentially active biochemicals). The company discontinued all its direct natural product research in 2001, however. As for other pharmaceutical companies, the structural diversity of natural products has been considered an important advantage. On the other hand, research on natural products is slower (and therefore more costly) and there is always the risk of not being able to get enough material for resupplying the drug discovery pipeline with larger amounts of the original material. In the early 1990s, Merck Sharp and Dome linked up with Costa Rica's National Institute of Biodiversity and started a systematic search for now drug leads from the rainforest.^{w11}

The project was established in 1989 in Santo Domingo, Costa Rica. Importantly, some 4% of the world's terrestrial plant species can be found in this 51 000 km² territory. Part of this project involves the government allocating a quarter of Costa Rican

Territory over two decades to an integrated system of protected and privately conserved wild lands. The project also pioneered the use of parataxonomists, local people with sufficient training to differentiate between species, to combat the shortage of actual taxonomists. The institute has successfully invested in local people and enriched the country's biodiversity inventory. A groundbreaking collaboration with Merck lead to an investment of \$1m (£550 000; €820 000) into the project.^{w11} Currently, the institute continues to establish smaller collaborative agreements with academic and private institutions in North America and Europe. With the renewed interest in such approaches, new drug leads from the rainforest are again entering the drug development pipeline.

The development of the United Nations' Convention on Biodiversity, a pact between world governments agreeing to commit to the environment and ecology in the face of economic development, has had a considerable impact on drug discovery from natural products. The convention identifies natural genetic resources as part of the heritage of the countries in which they are found and the traditional knowledge about plants to be acknowledged as the intellectual property of its holders. This means that informed consent is required from the stewards of the genetic resources—that is, the traditional healers, for commercial development. The benefits of the research and development as well as the financial rewards must be shared. The Fogarty International Center of the US National Institutes of Health has developed a programme for universities and businesses in developed countries to partner with institutions or groups in developing countries to successfully implement the convention. This effort is recognised as the International Cooperative Biodiversity Group programme, with the goals being the discovery of new pharmaceuticals and agricultural chemicals, scientific and economic development, and conservation of biodiversity.^{w12}

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Foundation programme for newly qualified doctors

Richard Hays thinks that the new UK foundation course should improve specialist training but may lack capacity

Born of necessity, developed with remarkable consensus, and piloted successfully for a year, the United Kingdom's new foundation programme for medical graduates has been launched.^{w1} The programme aims to ensure that all entrants to formal postgraduate specialist training have met the standards required to progress to that particular phase of lifelong learning.^{w2} Opinions vary about the role of these reforms and their impact on the medical education system and workforce.

The programme focuses on performance in the workplace, rather than only knowledge and skills, largely in response to recent scandals that highlighted problems with clinical governance, professional teamwork, and practitioners' honesty. The core competencies required to complete the programme match those laid down by the General Medical Council in *Good Medical Practice* and reflect reasonable expectations of the ability of junior medical practitioners.^{w3} Although the UK may be the first to formalise such a system, similar moves are being discussed in other places with similar systems of medical education and career progress.

The introduction of such programmes should not imply that medical schools are not doing their job. Medical education is a long process. In just four, five, or six years, medical schools are expected to cover the basic elements required for competent practice as a junior medical officer. The

foundation programme is meant to ensure that these competencies can be applied under supervision in the workplace. Learners learn more effectively when they are responsible for their actions, and it has always been the early hospital years that allowed graduates to develop the confidence to become competent practitioners. The weakness of the previous system has been the lack of time, resources, and expertise necessary to ensure that every junior hospital doctor reaches that point.

The new system aims to make every clinical experience a relevant, more standardised, better supported, and educationally valuable experience with specific and achievable learning objectives. Assessment will focus on practical aspects of medical work rather than examinations, and it will reward greater engagement by learners. The programme also brings new learning opportunities—such as posts in public health, primary care, and academia—where junior doctors can sample a broader range of options for hospital as well as non-hospital careers.

And the complete package includes bridges and shorter pathways to more advanced specialist training, removing at least some repetition of less valuable learning experiences, and recognising the more relevant and valuable placements that contribute to the achievement of specific career objectives. In summary, the foundation programme has the potential to provide a sound platform on which to build future medical careers more quickly and more flexibly.^{w4} As usual, however, it is the implementation of these reforms that raises the most questions. Although the programme has enormous potential for success, the stakes are high, and failure may not be forgiven. One response to the global shortage of medical workforces has been a rapid expansion of undergraduate medical education into new secondary and primary care facilities, where service loads are high and educational resources are stretched.^{w5} This means that the foundation programme will be competing for learning opportunities with medical schools and even with specialty training programmes, and capacity may not be sufficient for all levels of education to expand quickly.

What will students and new doctors make of these reforms? Junior doctors might now be treated more like

students, rather than junior professionals who are adult learners. Current students are reasonably concerned that there may be insufficient posts, diluted clinical experience, and the possibility that some may not achieve the required competencies and be stranded without a traditional career.^{w6 w7} And, although there are advantages to identifying graduates who are unsuited to clinical careers at an early stage, will reasonable alternatives be available?

The likely success of the programme in moving medical graduates to a wider range of specialties, including those where the need is greatest, is hard to judge. Workforce trends are difficult to predict. The recent international downturn in demand for primary care and the more general specialties may not recover,^{w8 w9} trends towards subspecialisation in primary and tertiary care may continue, and new specialties will continue to emerge. Much of the programme's success in directing careers may depend on whether, and to what extent, learners have inspirational experiences in such areas of need, and on the tension created by pressure to ensure that core competencies are also achieved in more mainstream areas of medicine.

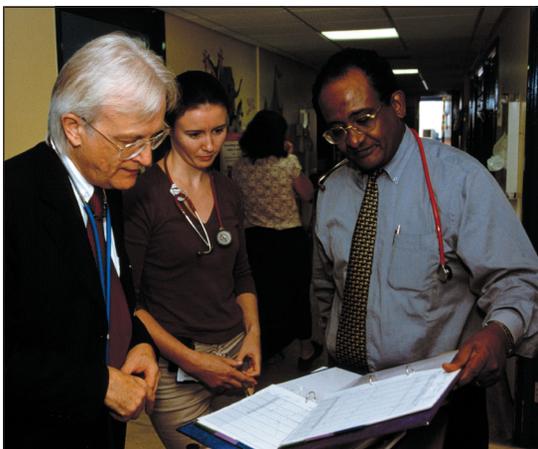
Furthermore, high quality teaching and learning do not happen by accident: a curriculum is initially no more than a document. Medical schools must engage with the foundation programme, helping to develop expertise in medical education and ensuring that the years spent as junior hospital doctors are part of a smooth transition for graduates. There will have to be rapid expansion in the number of medical graduates who have been taught to teach—those with formal training in methods of teaching and learning. Postgraduate training in medical education may have to become a formal requirement for at least some clinicians in each teaching facility, and medical education may develop into a formal postgraduate medical specialty. Lastly, the current difficult pathways for medical practitioners to gain formal educational qualifications may need to be simplified, with more flexible professional doctorates or membership courses. The success of the foundation programme, then, will require genuine academic development and support throughout the entire healthcare system, rather than in a relatively small number of elite teaching facilities.

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