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The constant gardeners

While pottering away in a garden near you, botanists are playing an increasingly sophisticated role in studying plant diversity. They should continue to broaden their scientific reach.

Thank goodness for botanical gardens. Without them, who would compile the flora of Mesoamerica? Who would identify a rare member of the Melastomataceae family, or determine the most likely pollinator for a newly discovered orchid? Imagine the intellectual poverty of a world in which no plant researcher studied anything but the model organism *Arabidopsis thaliana*, an unprepossessing mustard cress.

Universities do still house some taxonomists and whole-organism biologists. But as they retire, they are ever more likely to be replaced with geneticists or a similarly fashionable brand of molecular biologist, and their herbaria shunted off to the nearest botanical garden. "The number of well-trained taxonomists is shrinking," warns one leading systemic biologist. "They are a dying breed."

Not that the research interests of the gardens themselves are by any means confined to taxonomy (see page 860). Many are also now involved in molecular research, much of it addressing spheres that are neglected elsewhere because they lack commercial significance. The agricultural or pharmacological potential of plants naturally dominates the research agendas of plant scientists in industrial companies and, increasingly, in university botany departments as well. That leaves the botanical gardens to study the astonishing diversity of plant species, their relations to each other and their evolutionary origins. That's a massive research agenda for which little public financial support is forthcoming.

Nonetheless, gardens have got on with their work in their usual unassuming way. Many of their botanists are able to follow their own interests more closely than their grant-dependent peers at universities. Intellectually, that's often a good thing, but politically it has crept into the gardens' institutional culture and has sometimes prevented them from engaging as fully as they might with the outside world. They often enjoy good relations with universities and the public, but there is room for even more active participation in debates on topics such as climate change, deforestation and urbanization.

Some ambitious and outward-looking projects are going forward at the larger gardens. The Royal Botanic Garden Edinburgh is planning a £14-million ($24-million) education centre, for example. And at the New York Botanical Garden next month, a $23-million research centre will open whose work will include the investigation of the function of plant genes. Some academic botanists criticize this new direction as duplicative and a distraction from the garden's core work. But the genetic investigations pursued at botanical gardens are unlikely to overlap with university studies. Amy Litt, head of genomics at the centre, will investigate such diverse questions as the origins of seeds, the differences between hard and soft fruit, and the genes that determine the shapes of flowers, in part by sequencing genomes of plants such as the snapdragon.

The centre is part of the New York Plant Genomics Consortium, which includes the Cold Spring Harbor Laboratory, New York University and the American Museum of Natural History. The collaboration marks an effort by the garden to look beyond its own walls; it should be watched closely by those botanical gardeners who worry about possible marginalization within the wider research community. Some isolation has been self-imposed: there's a kernel of truth in the stereotype of the discipline as comprising a collection of reclusive eccentrics spending a lifetime on their particular interests.

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As well as looking outside, botanical gardens need to work more closely with each other to pursue the systematic collection of information about plants. Many gardens are loosely linked through an umbrella group, the Botanic Gardens Conservation International, based at Kew in London.

But this group focuses on conservation, not, for example, on the construction of databases. Several major gardens would each like their own systems to form the backbone of a global database. Closer cooperation is needed if knowledge of plants is to be integrated in a form that can be accessed by all botanists. It is past time for the largest gardens — at New York, Kew and St Louis — to work directly with each other to obtain financial backing for such a project. ■

More than the money

Technology-transfer offices are learning from their mistakes. So should the academics that they serve.

Academic researchers and the technology-transfer offices at their universities have had a prickly relationship since the latter first won a foothold on campuses two decades ago. Scientists sometimes complain that these offices are unresponsive to immediate demands, or that their generalist staff lack knowledge in specific scientific or technical fields. Once they do start working together, researchers too often view the hapless technology-transfer officer as a potential obstacle to the dream deal they had been plotting with industrial partners or financiers outside the university. Yet university technology-transfer offices have come a long way. It is time that truculent researchers recognized their worth and engaged with them constructively, in the common interest of the university and its surrounding community.

Staff in these offices have, over time, built up valuable expertise in helping to negotiate deals with outside parties. Although people sometimes assume that the offices are just there to earn cash for the

university through royalty arrangements, the thinking of university administrators has moved on. It is now widely accepted that, aside from the occasional jackpot of the sort enjoyed by Columbia University in New York (whose 'Axel patents' for gene insertion have earned it more than $300 million), technology-transfer offices are unlikely to generate large income streams. Instead, their principal role is to develop universities' ties with business in ways that should benefit students, staff and the surrounding community.

At last month's annual meeting of the Association of University Technology Managers, which drew some 2,000 technology-transfer officials from around the world to Orlando, Florida, the association's leadership declared: "It's not about the money." The meeting's busiest sessions were about the money, of course. But the point still stands: the remit of technology managers has grown far wider than just the collection of royalty payments.

For their part, technology managers find some researchers to be rather naive in their expectations regarding interactions with industry. Academics are sometimes slow to acknowledge potential pitfalls, such as pending ownership disputes over intellectual property. They can be too ready to sign over their future ideas in so-called 'honeymoon' deals, where a tightly controlled arrangement for the technology in hand would make more sense. More crucially, as technology managers see it, researchers take too sanguine a view of their would-be industrial partners, or their new-found venture-capital backers, on the other side of the table.

Like the technology managers, academic researchers are still on a learning curve. But they know much more these days about business deals, and are aware of the broader role that scientific research plays in economic development.

The interests of the technology-transfer offices are broadening out. For example, Cambridge Enterprise has some 20 staff and expertise that reaches beyond patenting and licensing agreements to the distribution of seed capital to promising young firms (see page 867). Research universities all over the world are looking for the latter: seed money from private sources is hard to find, and various mechanisms are under investigation to keep it flowing (see *Nature* **440**, 738–739; 2006). Even in technology hotspots such as Silicon Valley, a slowing flow of venture capital for early-stage company development makes it a topic for universities to address themselves.

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Ideally, technology-transfer offices should be a trusted resource for university scientists, working to protect their interests and establishing the right kind of relationships with commercial partners. Some academics can do that for themselves, but most need professional assistance.

Politicians and industrial managers increasingly view the research university as an essential source of the innovative ideas that drive modern economies. University technology managers and academics should work together to make the most of their strong position. ■

Neglected neighbour

Venus Express will go some way towards correcting a strange disparity.

Our two neighbouring planets form a stark contrast: one dedicated to love, a diamond in the evening, a pearl in the morning; the other dimmer, ruddier and tainted with bellicosity. You might think that each would get its fair share of our world's attention, but recently this has not been so.

The European Space Agency's Venus Express was due to enter orbit around Venus on 11 April, becoming its first Earthly visitor since Magellan, a NASA orbiter launched in 1989. In that interval, 15 separate spacecraft have been sent to probe the mysteries of Mars.

Yet Venus has plenty of mysteries of its own. Its high-level winds tear around at a speed no one can understand, and its surface bears the scars of an extraordinary cataclysm that overwrote most of its previous history less than a billion years ago. Scientists have developed little understanding of how this planet, so similar in size to Earth and yet so different from it, actually works.

In terms of maintaining Earthly interest, though, veiled Venus may have been mysterious for too long. The fact that the surface of Mars can be seen from Earth made it an appealing locale for fiction and fantasy. The astronomer Percival Lowell's vision of Mars as a desert planet, once Earth-like but now dying, gripped the twentieth-century imagination. As a distant desert, perhaps replete with strange and ancient inhabitants, Mars seemed to offer something akin to a new frontier. So while Venus stayed a planet, Mars became a world.

Closer examination of Mars has shown that aspects of its geological history can be made to fit into this story, offering evidence compatible with a wetter and more habitable past that could also be taken as an invitation to an inhabited future. A mixture of science and story-telling thus made Mars the planet most studied for traces of life, and most speculated on as a destination for human explorers.

Venus fans point out that it, too, has possibilities along these lines. Like Mars, it must have enjoyed a less inclement youth, with oceans in which early life may have bathed. Unfortunately, Venus has erased almost all obvious signs of its earlier state. Even so, there are no rock-solid grounds for excluding the possibility that remnants of a venusian biosphere persist in its clouds to this day.

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Nor is Venus an impossible candidate for human exploration. Its surface presents conditions more akin to the inside of an industrial chemical plant than to those encountered on a geological field trip. But journeys through its cloudscapes in dirigibles might still conceivably be less problematic than establishing a base on the cold, toxic, dust-devilled surface of Mars.

Without the narrative background into which our hopes for Mars are embedded, ideas of visiting Venus are unlikely to gain much traction. It is likely that Venus Express will yield gigabytes of fascinating data, greatly enriching knowledge of our nearest planetary neighbour. But if the mission is to usher in an age of Venus exploration, it will need to send back a compelling story too. ■