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What makes plants tick?

My botanical origin myth has me entering university as a maths/physic nerd and emerging a botanist. In truth, I emerged a phycologist – an algal nerd – but I transitioned through botany to get there. My first year curriculum was packed with advanced physics and 'pure' maths (I wasn't keen on the 'applied' kind), leaving room for a discretionary subject. I chose botany because I was curious about the natural world but didn't want to cut up animals.

What eventually converted me to the plant (and algal) world – as I'm fond of saying – was the image of a plant cell projected onto a wall in the Old Botany Theatre at the University of Melbourne. Within the cellulose impregnated cell wall there were sacks of DNA, to run the show, and others crammed with photoreceptors and the apparatus needed for the solar-powered conversion of carbon dioxide into oxygen and sugar. Along with other bibs and bobs. Who would have known?

A teacher friend took me aside once after I told this story and answered this question for me. Well, she said, 'You, for a start.' Despite not having studied biology at secondary school, it was apparently inconceivable I hadn't been told in junior science that plants were made up of cells containing things like nuclei and chloroplasts.

In any case, the image did the trick. I dropped maths and physics and headed full throttle into botany, seasoned with a little organic chemistry and genetics to help me understand what went on inside those cells.

By inclination, then, I seem to be a reductionist. To understand, I first break something down into its constituent parts, then reassemble

as each part becomes knowable. Add to that my acquired trade as a taxonomist, where I look for characters – shared and unique – to make sense of the world created by those plant cells, and you begin to understand why detail matters to me.

To be honest, though, an encounter with an unknown plant or alga typically begins with its *gestalt*, and then moves on to a more considered assessment through reducing it to a collection of traits. I apply the same approach in this first selection of essays, starting, I'm sure, with pre-formed views of some kind and then picking away at the question until I confirm my bias or – and yes, it does happen, good scientist that I am – I persuade myself to change my mind.

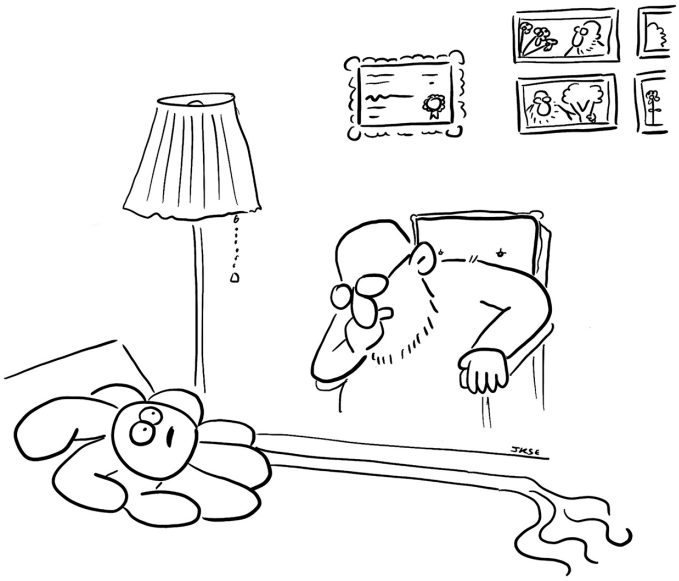
Some of these phenomena are well understood but often misconceived. They includes why we don't water our gardens in the middle of day, why some hydrangeas are pink, and why (almost) no amount of plant and flower material in your bedroom will suffocate you.

Others present me with that inconvenient or uncomfortable truth – that we just don't know; an observation that cannot be easily explained, or one that is no better understood through reductionism. This includes plants that seem intelligent, plants that 'talk' and why patting a plant might be good for it. In time I expect these extraordinary ideas to be proved or disproved, but for now, they mock me like the smile of Lewis Carroll's Cheshire Cat,[1] who, it must be said, was often right.

Stupid plants

Plants don't need to be like us to be smart

A lot has been written in recent years about plants being smart. Believe it all and you'll suffer nauseating guilt and regret every time you eat a carrot. You certainly wouldn't hold a Cabinet meeting near a scribbly gum or trumpet vine. At best, you might seek to commune with the green sentient beans in your vegetable garden.



It's frenetic out there. Drawing on chemical stockpiles the envy of *Breaking Bad*'s Walter White, plants can fend off hostile insect attacks by calling in squadrons of predatory wasps, at the same time warning their vegetable cohorts to prepare arms. Peas have been overheard conversing in clicks, reminiscent of the Khoisan in South Africa.

I'm sure you know by now that under our very feet, kilometres of fungal threads connect forest trees into a real, rather than Middle, Earth version of J.R.R. Tolkien's Fangorn forest, populated not by phlegmatic Ents but by collaborative beech and oak.[2] Plants (and fungi) do all this apparent thinking without the need for that distracting mush we carry around inside our heavy, bony skulls.

There is some evidence for these 'behaviours' and some justification for the view that we tend to underestimate the ability of plants to respond (rather sensibly in general) to the world around them. When this argument ratchets up to plants having some kind of

I was able to correct a couple of minor historical facts and to be even more circumspect and sceptical than I was already about golden ratios being found in nature, often or ever.

It remains a contentious subject, at least in my mind. A recent media release and scientific publication[33] from the University of Edinburgh reported on a 400-million-year-old clubmoss fossil with a sequence of leaf development that – if I read it correctly – is 1, 2, 3, 4, 5 and so on, so not a Fibonacci sequence.

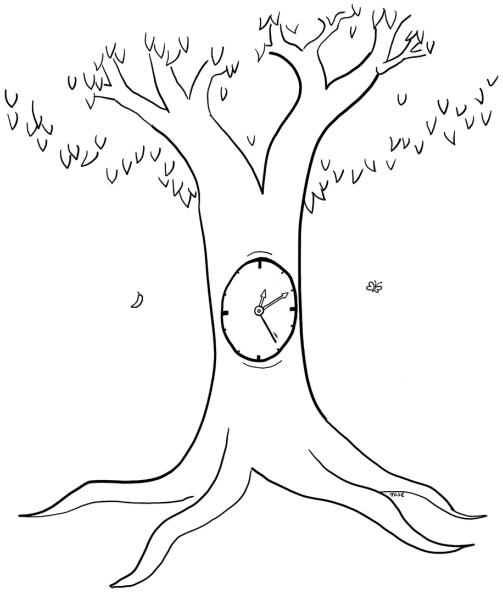
This doesn't surprise me, but I note that the media story says that Fibonacci spirals make up over 90 per cent of the spirals found in nature – citing 'sunflower heads, pinecones, pineapples and succulent houseplants'. All of these, I understand, are *more or less* Fibonacci but not always strictly so. Still, they are presumably *more so* than that ancient clubmoss.

It's flowering time

Plants might flower like clockwork, but you can't set your watch by them

Melbourne is proud of its floral clock, part of a 19th-century sensation reaching Australia in the 1960s. Thanks to a buried, concrete-encased, synchronous motor – Swiss made – the giant hour, minute and second hands glide over a circular garden of begonia, marigold and other annuals. In some years, long-lived box hedges have been added to provide better definition. Beautiful – at least to some eyes – and reasonably functional.

The original concept of a floral clock was quite different, and quite barmy. By the mid-18th century, natural philosophers (the word 'scientist' was not yet coined) were starting to get a grip on the variety and apparent vagaries of plant reproduction. Different plant species not only have different-looking flowers but those flowers bloom at different times of the year.



Some plants even open and shut their flowers at particular times during the day (or night) to take advantage of, say, morning or evening pollinators. This led Swedish biologist Carl Linnaeus,[34] creator of what we call our binomial system of naming (e.g. *Homo sapiens*, for us humans), to postulate a *horologium florae*.

With judicious planting, one can *imagine* a garden where the open flowers tell you the time day. In the Swedish city of Uppsala, where this idea first took root, you might bounce out of bed when the dandelion (*Taraxacum officinale*) flowerhead unfurls at 6 a.m., rush to work when it shuts between 8 and 10 a.m., grab a sandwich at noon when the field marigold (*Calendula arvensis*) flowerheads close, leave work at 6 p.m. when the sad geranium (*Pelargonium triste*) finally opens its dull yellow flowers and, if you like, party until the Queen of the Night cactus (*Selenicereus grandiflorus*) blooms at midnight.[35]

Let's get something clear up front, though. This is like picking your dream sports team of all time or forming the world's best supergroup.

2
Plants from elsewhere

'Without hard work, nothing grows but weeds'[1]

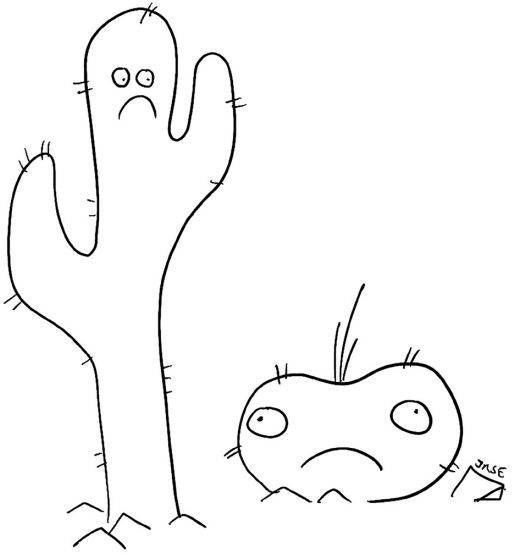
The wisdom proffered in this tired old saw is predicated on at least two dubious propositions: that weeds are not desirable and that hard work is. I'll leave the work ethic question to spiritual guides and philosophers but I'm happy to tackle the weed matter.

In Australia, weeds are demonised by farmers, environmentalists and a certain kind of gardener. There are good reasons for this stance – as I'll get to later in the chapter – but my starting point is that a weed has no intrinsic ethical merit or demerit.

In *The Bush: Travels in the Heart of Australia*,[2] Australian author Don Watson considers our tolerance of native Australian, exotic and local indigenous plants in gardens, and more broadly, in extra-garden settings ('the bush'). He laments the damage and displacement of native species by rampaging weeds but also the futility of returning land to some imagined original state or trying to create a garden with no impact on the broader environment. And there's the rub.

The most compelling reason for floral exclusivity is to avoid adding to Australia's 'weed problem'. That problem is a big one, with scientists at the CSIRO estimating a cost to Australia of over $4 billion a year in control and lost production.[3] Humans have transported some 28,000 plants species to Australia, about the same number as the natives species that grew here before European and First Australian arrivals. Most of the introductions were deliberate, and more than 2,500 now grow and spread in Australia without our further assistance.[4]

Gardening is – at its most fundamental – the introduction and encouragement of plants we like and the discouragement of those we



why, but one motive postulated was a hatred of exotic plants – there are no cacti native to Australia.

The frenzied attack on all the tall, upright succulents occurred in a week that was not unusual back then, where Australians were having their attitude to Indigenous Australians and overseas asylum seekers tested almost daily. At the core of all these issues was a fundamental question about who can call Australia home and how we deal with the answer.

In one of his *Encounter* essays,[22] Milan Kundera quotes Vera Linhartova, a Czech author who like himself moved to Paris and from there wrote in French, as saying 'the writer is not a prisoner of any one language'. A great liberating sentence, says Kundera, and only the brevity of life keeps a writer from drawing all the conclusions from this invitation to freedom.

Lovely lines and part of a plea for writers in exile to be considered neither of their home or adopted country, but what he calls 'elsewhere'.

cultivars can be shown to be less invasive than others, then they may be delisted. Prosecuting these cases will be fascinating to watch and may well have implications for how we treat our pretty purple loosestrife.

April 2024

Boab dreaming

People and plants with a shared history

The very best definitions of a *native* or *indigenous* plant, according to our now much-cited Brisbane botanist Tony Bean,[59] combine elements of longevity ('in that region for thousands of years'), absence of human

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Garden plants and landscapes

Can you maintain and honour a landscape design after the inevitable demise of the designer and the equally inevitable decline and death of its constituent plants? At one extreme, the design might be viewed as colour-by-numbers outline, where future garden carers and owners simply recolour it now and then, as per the instructions. Like for like, in terms of species composition and placement. Curve for curve, and vista for vista, in terms of outline. Nothing wanted or needed in terms of creative input.

This assumes such an approach is possible. Plants grow larger, change in shape and form, and then die. Seldom can you replace some landscape element with a fully sized replacement, nor should you, for the stability and health of the new plant. Overlay that with changes in climate and surrounding environment which may alter what will grow successfully in the garden.

Then there is garden fashion or personal taste. Should that have any place in a heritage garden? I think yes, which brings us to the other extreme. Anything goes.

In this scenario, the original designer is treated as muse perhaps, or simply setting the tone and style but not the detail. This is more analogous to an art movement approach. Our garden is Art Nouveau, Post-Impressionistic, Old Master and so on; or if you prefer, baroque, picturesque or gardenesque. Abide by a few rules then do what you like.

A happy middle might be struck by adhering as closely as possible to the design intent and aspiration. For a home garden, this might be a sense of geometry and relationship to nearby buildings or other

landscapes. For a botanic garden, its role as a place of beauty as well as science, learning and conservation comes into play. For a grand garden or park, something more akin to the botanic garden philosophy, we might put ourselves in the shoes of the designer but on today's turf. In all cases, we could engage a 'like-minded' designer to guide us.

To torture that art analogy a little more, gardens are not generally, I think, like a finished work of art, to be restored and preserved as close as possible to the original. They are more like a piece of music or theatre, to be reinterpreted and reimagined as desired. Sometimes, of course, they may be kept (performed) in their original form. If you want. Eventually, like a building, the garden must be propped up and repaired, or replaced. Never, I would suggest, reconstructed in faux style unless that is the eccentricity you want to feature.

British author and historian of gardens (and confectioner), Tim Richardson, weighed into this debate in 2014, with a typically refreshing and challenging essay for Australian audiences.[1] For 'highly personal' historic gardens, he favours the 'like-minded' designer approach, or indeed an 'equally talented' designer. For a garden of more generic design, Richardson's preference is repair over restoration.

I mentioned Richardson's perspective in a blog post on Roberto Burle Marx, posted after a visit to his garden (*sitio*) on the outskirts of Rio de Janeiro, Brazil.[2] The current owners of that property were faced with a decision about repairing what was there or pursuing the spirit of the original garden as a creative and experimental space. When I was there in 2015, they were flirting with inviting new designers to pursue Burle Marx's intent.

Australian garden writer Kim Woods Rabbage commented on my blog at the time with a note of caution. For a designer of such importance, she said, some of his original work must be kept intact. This is in the same way we want to see the work of artists like Picasso, Matisse and Warhol, rather than (or in addition to) those they have