6

WE DO THINGS DIFFERENTLY NOW

In which the reductionist view of the world is overtaken by consideration of the system as a whole.

The various biological disciplines began to reconnect from about the middle of the twentieth century, after Julian Huxley published *Evolution: The Modern Synthesis*. The world had changed: most scientists accepted Darwinian evolution as a 'given' and humanity has, latterly, become aware that it is itself a species at risk from its own ability to wreak environmental destruction. From a wholistic perspective, the world had been recognised as a continually changing pattern of self-organising, cooperating systems involving all life. And, as Dobzhansky (1973) remarked, nothing in biology made sense except in the light of evolution.

The second half of the twentieth century therefore saw a serious challenge to the reductionist habit of breaking things into their pieces. By then public opinion was moving forward from the heritage of the scientific Enlightenment to adopt the idea of wholist interpretations of events. A social movement embodied these concepts: the 'flower people' of the 1960s, the hippies, proclaiming the ideal of universal belonging. Wholistic science followed. It recognised that, in a complex, fast-changing world, the important questions could not be answered by studying their parts alone. Food security, a stable atmosphere and the integrity of the oceans are only a few of the complex issues that urgently needed, and still need, to be dealt with as a whole.

You will by now have noticed that we have consistently used the traditional spelling 'wholistic', to describe those relationships which form a whole that is not only greater than, but also different from, the sum of the parts. The word dropped its 'w' as recently as 1926, when the respected South African statesman and polymath, Jan Smuts, wrote *Holism and Evolution*. Smuts, was, among other things, a philosopher and scientist who moved beyond the Enlightenment to introduce the idea of the 'holistic' development of organic systems. He was a strong critic of the 'struggle for existence' view of the world. He wrote that the supposed struggle is:

> an exceptional and not the usual procedure of organic Nature. This world is at bottom a friendly universe in which organised tolerant co-existence is the rule and destructive warfare the exception, resorted to only when the balance of Nature is seriously disturbed. Normally Natural Selection takes the form of comradeship, of social cooperation and mutual help. Normally also the organic struggle is very much in abeyance, silent effortless constant pressure of the physical and organic environment exercises a very powerful influence.

We have several reasons for using wholistic with the 'w' here. First, it links the human story to the wholistic perspective that existed before René Descartes launched the scientific era with his division between mind and matter. The chants of the druids, the epic tales of the Iliad and the Odyssey, the dream of Greek democracy and the creative works of the Renaissance all belong to a pre-science era where the whole was more important than the part.

Another reason for moving back to 'wholism' is the controversial nature of 'holism'. Among the various uses of the word, to be holistic was thought of as a claim to know all about everything. It could then, with some justice, be summarily dismissed as an impossible task. Alternatively, while opponents considered that it might have some merit, it was considered to be a lightweight idea with no solid foundation, an overambitious effort to assemble the sum of the parts into an indivisible whole.

When thinking about evolution, however, to be wholistic is none of these. Rather, it is to understand that it is the connections and cooperation, not the competition, between members of biotic communities that make up natural systems. Humans are therefore also to be considered in terms of their connections and interactions between their biological, social and individual places in natural systems. Finally, the adding of 'w' is a reminder of the central theme of this book, that connectivity and cooperation is the essential core of evolutionary change.

Scientific and public interest has moved on from the limited truths available from a narrow focus to seeking wholistic descriptions of the biosphere. James Lovelock's concept of Gaia as a single self-maintaining entity has been marked by its enormous popular appeal. Understanding Gaia in terms of its interactions and, at a lower level, understanding human constructs by exploring their relationship with Gaia now have priority. Scientific explanations using narrative and metaphor are of greater importance than the pursuit of detail.

Earlier, we tried to show the choice was not between reductionism or wholism, but that both had valuable contributions to make to ideas of how the world worked. Our metaphor for wholism proposes that understanding the world means taking the once-separated strands of knowledge and weaving them into the network of connectivity with which Gaia invests the planet.

Evolution: The Modern Synthesis appeared in 1942. This great work by Julian Huxley was a indeed a masterpiece of synthesis. It was, at the same time, a hymn to the success of the reductionists *and* a paean in praise of wholism; that *and* this – note the italics. It justified both approaches to the world by bringing together reductionist evidence from a wide range of different biological disciplines, including genetics, embryology, ecology, biogeography and taxonomy, and showing how each, taken singly, sheds light on aspects of evolution, and taken together reveal it as the overarching concept of life on Earth. It is probable that as many as half of all professional biologists were sceptical about Darwinism before the *Modern Synthesis*. Five years after publication it would be fair to say that fewer than 1 per cent of biologists had doubts about its validity. The *Modern Synthesis* had become the handbook of neo-Darwinism.

Even the basic role allocated to DNA changes when it is considered in its wider context. In fact, it is of such wide appeal that it has now become a popular catchcry, an acronym that appears to explain much but, in popular use, wildly distorts the original meaning. Thus, assertions like 'it isn't in his DNA to do that' or 'the ability to play the piano is in my family's DNA' are gross distortions of DNA's real role. DNA is like a carrier pigeon, but that is all. No-one expects the bird to act on the message it is carrying. DNA is only the carrier of the evolutionary message. Other molecules do the work.

To understand inheritance, we need to understand the method by which every cell gets its ration of DNA and the context in which it works. We have already noted that each human genome contains about 20,000 genes. Noble (2006) used the brilliant metaphor of the musical organ to describe DNA's role in inheritance. This was an excellent choice since the world's largest organs have close to 30,000 pipes, not too many more than the number of genes in the human genome. Together, the pipes can be made to play every piece of music ever written. Together, genes can be made to create every human being as a unique entity.

The pipes cannot, however, initiate the music by themselves, just as DNA does not initiate the living organism. An organist is needed to convert the musical score to a unique piece of audible music. The organist is expected to play the notes in the required context, and with specified order, timing and emphasis, although circumstances can change their interpretation. The juxtaposition and context of the notes can lead to a cheery tune or, less often, a masterpiece.

Within the cell, an array of different molecules interact with the DNA code and follow the instructions on how it should be 'played' or, as it is more usually put, 'expressed' in a living organism. The molecules within a human ovum, say, that interact with DNA, will build the human being according to specified order, timing and emphasis.

Who was the composer? The composer who wrote the musical score for the organ to play need not be the organist, but someone perhaps far away both in distance and in time. The composer of the DNA 'score' was natural selection itself, and it started its composition billions of years ago. To work the metaphor to death, natural selection has created billions of 'tunes'; these are the different species. Some have been briefly successful and then died out, while others, the so-called living fossils, have persisted without much change for up to half a billion years, and still others continue to be reinterpreted at every generation.

A very important characteristic of the genetic code is that it provides context. DNA is wrapped up into packages called genes. The genes are arranged on chromosomes. They do not, however, necessarily stay in the same place with respect to other genes. Cell division moves them about, and there other mechanisms, such as 'jumping' genes that move from one chromosome to another. The way these genes are expressed depends on the other genes alongside which they find themselves, that is, their context. Context is another way of saying 'connected with'. The connection may not be an actual physical one, but one mediated through other molecules. It is a wholistic system; without understanding the connections one cannot understand inheritance.

The recognition of wholistic systems continues beyond the genetic code. With the advent of electron microscopy, Altmann's bacteria-like granules turned out to be energy-producing ancient cells modified and living *within* a parent cell. Altmann's observation was an inspired anticipation of the Margulis symbiotic theory, put forward 80 years later, of the origin of modern cells as a collaborative enterprise between ancient cells. Like all good ideas, there had been early suspicions that such symbiosis might be the case; in particular, insights gained from studies of lichens, whose fungal cells are accompanied by symbiotic green cells that once were primitive blue-green algae. Margulis's work in the 1970s was a return to the study of the whole, and for 20 years was greeted with scepticism. Her insight, however, led to the rediscovery of the cooperative events that underpin multicellular life throughout the living systems of the planet.

Our image of the biosphere today is of the great, three-dimensional, network of connections that we can now call Gaia, a widely accepted, appropriate title for the interrelationships between humans, animals, green plants, ancient cells, oceans, atmosphere and geosphere. Together these add up to a self-organising entity. This is not so different from the views of the ancient Greeks, who believed that they lived in a united world, at the mercy of the gods of the sky, the land and the oceans that they personified as Zeus, Demeter and Poseidon. The idea of connectedness is also inherent in the aphorism beloved of the old alchemists 'As above, so below'. It originated in the Vedas, the ancient Hindu scriptures, as 'that which is Below corresponds to that which is Above, and that which is Above corresponds to that which is Below, to accomplish the miracle of the One Thing'. It implies that whatever happens on any one level of reality also happens on every other level. William Blake's *Auguries of Innocence* tells the same story:

> To see the World in a Grain of Sand,
> And a Heaven in a Wild Flower
> Hold Infinity in the palm of your hand,
> And Eternity in an hour.

Aristotle wrote that the totality is not, as it were, a mere heap, but the whole is something beside the parts, and was echoed by Euclid's Axiom number 5, 'the whole is greater than the part'. Leonardo da Vinci urged all to learn how to see – to realise that everything is connected to everything else – and Shakespeare noted 'one touch of nature makes the whole world kin'. In 1854, Chief Seattle, of the Suquamish People, was reported to have given a dignified address on the subject to the Europeans who were settling in his territory in the Puget Sound. The quotation that follows was actually 'recreated' much later for another purpose:

> The Earth does not belong to man; man belongs to the Earth. All things are connected like the blood that unites us all. Man did not weave the web of life, he is merely a strand in it. Whatever he does to the web, he does to himself.

To make this concept absolutely clear, Aristotle, when proclaiming the Greek equivalent of 'the whole is more important than the sum of the parts', was actually referring to Greek theatre. The whole play has an integrity and meaning, one that makes an impact on the audience that is independent of the contribution of any particular actor. Agatha Christie's famous play *The Mousetrap* has been running for 60 years with innumerable changes of cast and venue, yet its impact on a new theatregoer is not diminished. This wholist metaphor holds true for any cooperative venture. When the relationship is truly cooperative, then members make their own contributions to a meaning that transcends their own participation, to create a new and different and more potent whole. A great enterprise may continue for 100 years in a steady state, continuing its business even though the staff turns over many times.

Elinor Ostrom (2000) received the 2009 Nobel Prize for establishing the economic and ecological advantages of working with the whole of a community. She demonstrated that when natural resources are pooled, the rules for managing those resources evolve to make the system sustainable – provided that decision-making is transparent and democratic. The United Nations and the World Bank share these wholistic ideals, however difficult their realisation.

Reduction to parts still provides a useful tool in a wholistic enterprise, since science progresses by accretion of knowledge. Understanding of the whole becomes more complete as more of the unknowns become known. On the other hand, in contrast to reductionism, wholism is the idea that every whole has emergent properties, and that these cannot be predicted from knowledge of the parts. In another context, Donald Rumsfeld, US Secretary for Defense, put it less than succinctly in 2002:

> There are things we know that we know. There are known unknowns. That is to say there are things that we now know we don't know. But there are also unknown unknowns. There are things we do not know we don't know … And each year, we discover a few more of those unknown unknowns.

Even a quick look at the evolutionary history in Chapter 3 suggests that the evolutionary process is built on a series of emergent phenomena. Although emergent phenomena are commonplace, we rarely see them as such. Mistakenly, we tend to look at a whole as a static system – a reductionist view – whereas in a dynamic system, wholes are consequences of the influences of other wholes. Recurrence of a different spring in the northern and southern hemispheres is a consequence of the spin of a planet with a tilted axis in a solar system. Individual plants and animals are consequences of a fertilised ovum. Humans are the consequence of a particular pattern of DNA expressed in a social and physical context. Microscopic examination of either an unknown seed or a fertilised egg gives no clues to its final destiny. WB Yeats wrote:

> O chestnut tree, great rooted blossomer,
> Are you the leaf, the blossom or the bole?
> O body swayed to music, O brightening glance,
> How can we know the dancer from the dance?

The nut that is planted becomes the 'tree' and the 'tree' is all of the things listed by Yeats in the one living form. One cannot know the 'dancer', nor the 'dance', by simply studying the choreography. 'Dancers' may be changed and the new ones master the same choreography with different interpretations, while the dance itself will be influenced by different settings.

Darwin was a meticulous field observer with a formidable mind, but even he was not the first to put forward a theory of evolution as an explanation of the whole of life. His grandfather had done so before him. And, quite independently, so did Darwin's contemporary, Alfred Russel Wallace. Their views of evolution derived from close observations of the natural world, as well as from personal reflection. Darwin, from first principles, deduced that natural selection depended at least as much on collaboration among living things as on competition. Darwin clearly saw the golden thread, the connectedness of things. We have remarked on this before and make no apology for repeating it; at the end of the *Origin of Species* he was able to describe this marvellous vision in his 'tangled bank' paragraph.

In the second half of the twentieth century, the wholistic approach, the idea of cooperation among contributors that created something unpredictable, was finally coming into its own. The newly named field of ecology provided a broad, multidisciplinary and theoretical base for studying environmental systems that eventually produced James Lovelock's concept of Gaia as a system of interacting cycles controlled by feedback and feed-forward activation and inhibition.

Just as the reductionist interpretations of new information were influenced by the social context of their times, as discussed in Chapter 4, so too with wholism. The treatment of physical and social phenomena as sets of unrelated data changed to a search for ways to explain the same information within an interconnected system. Darwin's proposal of natural selection as the basis for the origin of species is a perfect example in itself. He gave us the prototype, the 'tangled bank', for a wholistic explanation that influences us still.

Even in Darwin's own time there were alternatives to the Establishment's hierarchical thinking. The group known as the romantic poets provided a wholistic counterpoint to the prevailing technological perception of the world. John Keats's 'trees young and old, that do a cooling covert make' gives the reader a very different image from trees cut down to fuel the Industrial Revolution. William Blake's 'dark satanic mills' and 'a robin redbreast in a cage puts all Heaven in a rage' symbolise their oppressed workers and, later, Charles Dickens's starving Oliver, in *Oliver Twist,* who asked for more, awakened the public consciousness of the terrible social impacts of the Industrial Revolution.

Even Darwin was concerned by the absence of fossils providing links between major groups of animals, although he confidently predicted that they would be found. Having been told to look for them, palaeontologists have been finding missing links in every evolutionary line ever since. The missing links in human evolution proved to be a consequence of too few hunters of human fossils on the ground.

Statistical theory advocates a certain care in interpreting data. The first Neanderthal human skeleton was discovered in the 1850s. If you have a sample of one out of a large population, then it is most likely representative of the average, because by definition the average is the most common form of that population. Sadly, a single observation was wildly out in this case. The Neanderthal individual was hunched, distorted and ogre-like. The skeleton later proved to be from an old, bent and arthritic man and far from the average for the healthy hominin. Unfortunately, in the public mind it became the model for all Neanderthals, and in the hands of creationists it became the distorted image of a kind of monster that, like 'nature, red in tooth and claw', reverberated down the years. Since then, many 'healthy' Neanderthal skeletons have been discovered. The richness of the human fossil record compiled over the last 50 years has finally dispelled the monstrous image left over from the nineteenth century.

The twentieth century move from a reductionist to a wholistic perspective changed our thinking in many significant ways. Behavioural studies had reached their reductionist zenith by mid-twentieth century. After that, there was a welcome move away from BF Skinner's view that animal behaviour could be explained by 'operant conditioning'; the idea that if a random behaviour has a good outcome then repetition establishes that as a normal pattern of behaviour. Conversely, if such a behaviour leads consistently to pain then avoidance becomes the established response. By training through reward and punishment, dogs could be induced to attack their owners, and humans to reject ingrained behaviour. Operative conditioning was reductionist in the extreme. It was less than helpful in describing the role of dogs in human society; and even less helpful in assessing the potential learning capacity of human beings.

Of the three co-winners of a Nobel Prize for animal behaviour in 1973, Niko Tinbergen and Karl von Frisch seemed happiest with this sort of reductionist analysis. This is not really surprising as they first worked on the behaviour of wasps and bees. The third winner was Konrad Lorenz, who had a foot in both camps. He famously found that new-hatched greylag geese 'imprinted' on him in the place of their mother goose. This is now known as a common phenomenon among animals; one of us once drove a big white panel van alongside a lambing paddock and it attracted the fond attention of a couple of newborn lambs that mistook it for a very large mother, much to the farmer's annoyance as he had the job of reuniting them with their mothers. Lorenz went on to observe the survival value of this imprinting during the period before they learned to forage independently. In much the same way, instinctive processes of adult mammals, such as fight or flight, are superseded by the later development of their capacity to modify the response according to the environmental context. Humans have infinite possibilities in satisfying their needs but even bees have a little wiggle room in their food-seeking behaviour.

In the 1980s, the wholistic approach was at last coming into its own. Ecology, now an established discipline, had started looking at human ecology and social systems in the evolution of societies. The legitimacy of including social, ethical and artistic evidence as well as the biophysical was clearly demonstrated by Lewis Mumford's 1953 *The History of the City.*

Wholistic ways of reinterpreting the outcomes of technological change include studies of hard (biophysical) and soft (social) systems. Reductionists are still contrasting the two in the twenty-first century, decades after the originator, Peter Checkland (1999), deplored their inability to put his then-new ideas of soft systems methodology into practice. Urban and environmental managers have largely moved away from regulatory responses to environmental change. Urban planners now include the needs of neighbourhoods and 'common ground' as well as 'roads, rates, and rubbish'. The current practice of adaptive environmental management brings together biodiversity, ecological systems and human livelihoods.

As an antidote to the extreme specialisation of the past, multidisciplinary teams were formed in order to deal with complex problems. When this simply continued the reductionist practice of separate contributions from the usual disciplines, the next response to challenging problems was to become transdisciplinary. Other ways of knowing, in addition to the formal disciplines, were included in policies for administration, research and education. Community, expert and organisational knowledge gave fresh insights into different aspects of the same events.

The use of the integrative word 'sustainability' came to the fore with the realisation that humans were responsible for environmental disruptions that put their own future at risk. The opening of the protective ozone holes at the planet's poles let in the Sun's UV light and exposed the entire human population to the possibility of UV-induced cancer. This time there was effective response: international cooperation led to the banning of the causative agent, the fluorocarbons. The lesson has been learned. Look about you: children's playgrounds are covered in shade cloth; chemical sunscreens claiming sunscreen factors of 70 are common (but check the validity of the claim). Even more important was the lesson about the close relationship between our planet and the rest of the universe.

Unfortunately, the same cannot be said of the reaction to the overproduction of carbon dioxide from burning fossil fuels. Here the public outcry at the risk of global warming from the atmospheric increase of the gas has been politicised. The dangers have not yet been enough to counter the influence of the industrial fossil fuel lobby, although the bushfires in Australia and elsewhere in 2019–20 have dented the granite facade of political climate change deniers. The people understand, even if their so-called leaders do not. The response of the latter has been to go on as before: more of the same (more coal and oil), delaying the enaction of a collaborative international response for abandoning coal, reducing gas emissions and investing in renewable sources of energy. It is, however, comforting to see that the private sector is responding well. They have read the evidence and self-interest is at work.

Humans now have responsibility for many of their own evolutionary selection pressures, a circular process that was not apparent in Darwin's own time. It has been recognised that a wholistic response requires social as well as environmental change. Yet another step towards a wholist approach to complex problems was the work of two social planners, Rittel and Webber, who labelled problems that had no current solutions, and required changes in the society that created them, as 'wicked'. Wicked problems were not necessarily moral problems; rather, they were wicked in the level of difficulty for their solution.

Rittel and Webber point out that solutions to wicked problems require responses from multiple interests, and so can have no single answer. Nor can they have a final answer, since social change brings fresh changes in their wake. The opposite of wicked problems are tame problems, problems that can be addressed through simplified single-factor responses. An example of a wicked problem is the need to balance the planetary atmosphere so that we can maintain the existing conditions for life on Earth. The simplest and most obvious step is to legislate to reduce the carbon dioxide emissions from industrial processes. The real dilemma is how to address all the aspects of a society that led to overproduction of the gas in the first place.

Human evolution continues, even though the selection pressures we once enjoyed have been radically altered by the changes we have made to our own circumstances. We have become unknowingly responsible for our own evolutionary direction and we are now in previously untrodden territory. Whatever our decisions, the Darwinian process of natural selection will continue just the same. The difference is that humans can circumvent environmental change, and even predict – to a certain extent – where and what will happen. Typhoid fever and diphtheria, outcomes of the crowding in the new mega cities, were defeated with the introduction of public health measures, clean drinking water and the use of carbolic soap. Mosquito-borne malaria was greatly reduced through use of insect repellents, changes in dress and the use of mosquito nets at night. Prevention, however, still escapes the experts; remember, the mosquito and the malarial parasite evolve too!

We are left on the horns of a dilemma. We can continue with our familiar ways of living on the Earth, ways that have themselves induced the significant problems we face, or we can take control. We can take control by identifying and acting on new ideas appropriate to life on a finite planet. This means taking advantage of the initiatives emerging in the move to a wholistic perspective.

Consider one of the foundations of our lives: how we choose to produce our food. A flood of information is emerging on the health consequences of long-standing land management practices. High usage of herbicides, insecticides and chemical fertilisers has been found to threaten the nutritional value of foodstuffs derived from monocultures of crops and cattle. Treatment of local grasses as weeds, stall-feeding cattle and the use of growth stimulants further impair the extent to which natural systems can restore the balance. Under conservative social pressures, farmers cannot easily abandon these now-traditional ways of managing the land. Drought degraded land and farming to the point of bankruptcy, and is considered responsible for an increasing rate of farmer suicide.

There is an alternative. Charles Massey's 2017 book, *Call of the Reed Warbler*, documents a revolutionary change from what he calls mechanical agriculture to regenerative farming. Farming practice is changing to allow natural systems to retake control, this time with encouragement from the farmer. This form of farming takes into account the whole of the landscape and the whole experience of living in that landscape. Personal accounts of the experience of taking up this challenge report increases in incomes, markets and nutritional levels of produce, and improved work-life balance.

Massey's conclusion is that although the case for regenerative farming has already been made, a different way of thinking is needed to put it into widespread practice. What is required are minds open to new practices, social and environmental, sensitive to relationships, and expecting and embracing the inevitability of evolutionary change. He is not alone. Meadows et al., in *Limits to Growth* (1974, updated in 2013), are helping to change the world's thinking about the future. Meadows's recommendations are to start with the vision, be open to any path by which the vision can be realised, be patient and persistent and be true to the vision. Humanity is at a great turning point in its history, perhaps as great as the discovery of fire or the invention of the wheel.

A continuing issue for which no solution has yet been found is the heating of the Earth's atmosphere and oceans. Separate government agencies, education departments, research teams and community advocacy groups have developed different approaches: carbon dioxide reduction, pollution control, policy development, change management, maintenance of biodiversity and the rest. Work by one of the present authors, Brown, (Brown and Harris 2014) on wholistic decision-making has explored the wicked problem that still exists, even in a fading reductionist era, of establishing connections between the social structures and courses of action. Single disciplines still maintain monopolies on their own forms of knowledge about education, and their applications in the professions.

An early effort to combine the decision-makers involved bringing together as wide a group as possible in workshops. At each workshop, the participants were in search of whole-of-community change. In time, there were more than 300 of these workshops spread across five continents. A pattern began to emerge. Contributors to the workshops brought, separately, to the discussions individual, community, specialised, organisational and wholist ways of approaching a shared issue. Each of these ways had its own objective, language, timetable and knowledge store. They were so distinctive that it seemed reasonable to describe them as each being a knowledge culture of their own. When placed together in the same workshop, members of a community could be persuaded to talk to one another, and even collaborate on responses to a shared issue. In this way, wholistic programs on one issue were expanded to include a wholistic understanding of environmental and social change.

Midway through the workshops it became apparent that there was another distinct subculture of members. These were often the instigators and/or the drivers of the wholistic programs. They might have come from any one of the knowledge cultures, or they might have been independently minded. In each case, they drew on different, though overlapping, sets of knowledge from their own knowledge cultures. These individuals were reflecting on the biophysical, social, ethical, artistic and sympathetic aspects of the issue for themselves.

The notable success in arriving at a team response to a wicked problem was obtained by treating all workshop members as individuals, rather than as representatives of their own specific knowledge base. Continual feedback through mutual dialogue led to mutual learning among the members. It brought together the full range of available evidence on each of the issues, so that each member could contribute equally.

The next question, then, must be, where does all this activity sit with respect to natural selection within and between human populations? We know that the pressures on the human species are unprecedented, and that the problems it faces call for wholistic solutions. The question is, of course, much more difficult. While we can describe what has happened, and what is happening to the species, the present is so complex an interaction between multiple factors that what will happen in terms of natural selection requires a crystal ball! Nevertheless, in Chapter 13 we attempt a lighthearted look at a future, and identify some of those pressures and the possible responses.

This text is taken from *Cooperative Evolution: Reclaiming Darwin's Vision*,
by Christopher Bryant and Valerie A. Brown, published 2021 by
ANU Press, The Australian National University, Canberra, Australia.

doi.org/10.22459/CE.2021.06