



Australian Government

Chief Scientist

DR ALAN FINKEL AO

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Planting the seeds of citizen science

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**University of South Australia
ADELAIDE**

Let me start with an impossible to answer question. Who invented citizen science? It depends who you ask.

The birdwatchers say that it began with the Audubon Society and the great Christmas Bird Count, in 1900.

The weather-watchers say that it began with Thomas Jefferson – yes, US President Thomas Jefferson.

Legend has it that in 1776 he went to Philadelphia to sign the American Declaration of Independence. Then he popped into the hardware store and picked up a barometer to take back home.

He thought it would be fun if he and his Founding Father mates across the country made weather observations and shared their notes.

It was the birth of the National Weather Service that exists to this day.

As for the historians... well, they say that all science used to be citizen science. It was *professional* science that had to be invented.

As Chief Scientist, I have to be neutral – so I refuse to tell you who was first. But I do know that Australia has played an important role.

We have a long history of great citizen science. And we ought to hear more about it. So let me tell you just one of our stories – a story that begins right here, in Adelaide.

In the Year 1847, there was a man named Ferdinand Mueller. He was born in Germany, but he'd come to Adelaide... with a dream.

He wanted to be a botanist: the best and boldest botanist in all the world.

And so he would collect specimens of every plant in Australia.

Every plant. In Australia.

Off he went, marching on expeditions all around South Australia, from Queensland to Victoria, up mountains and across the deserts, for the better part of a decade.

He demonstrated beyond any doubt that Australia was very large and had a lot of plants.

And then inspiration dawned.

He realised that the way to collect plants wasn't to walk around collecting plants – but to sit very comfortably in Melbourne, collecting collectors.

And that's what he did. He put advertisements in the newspapers calling for volunteers. And he set up a network of amateur collectors – yes, citizen scientists – all over the continent.

Over the next forty years, more than 1300 people would contribute to Mueller's research

That includes more than two hundred women, and twenty young girls, the youngest just six years old when she collected her first plant.

One of the women was Mary Kennedy. Imagine her life.

She lived on a sheep station in Wilcannia on the Darling River in New South Wales, about as far inland as you could go without falling off the map.

She was the mother of eleven children.

And she collected more than five hundred plants for Ferdinand Mueller.

Mrs Kennedy didn't just collect the leaves and seeds and flowers. She asked the local Indigenous people for the names of these plants, and their uses.

So she left a legacy not just for botanists, but for everyone who cherishes our Indigenous heritage.

And Mueller gave her a legacy in exchange. He named a species of grevillea in her honour: *Grevillea kennedyana*.

Now in those days they didn't call it citizen science. But in hindsight, that's exactly what it was!

It checks off my Big Three criteria for any great citizen science endeavour.

Number ONE, it has to be good science.

This wasn't about tripping through the fields collecting flowers. Ferdinand Mueller stressed that point time and time again. *He* was a world-famous botanist – yes, he said that all that time, too. But it was true, and he was proud of it.

And he wasn't about to put up shoddy work for the learned academics in London and Paris and Hamburg and Boston to rip apart. He needed good data!

So he told his collectors the scientific goal. He explained how their contribution would assist.

And to ensure that they did it properly, he sent out envelopes suitable for collecting the samples, along with a little book of instructions, with helpful diagrams.

So when a woman on a sheep station picked up her basket and headed off into the scrub, she did so in the name of science.

Yes, she enjoyed the outing. But it was a package deal – fun and science.

When she put samples on the mantelpiece to dry, that was science.

When she carefully packaged them as per the instructions in the envelope, with details on the date and place of collection, that was science.

So Number One: citizen science has to be good science, consistent with the rigorous standards we apply to every other experimental process.

SECOND rule, citizen science has to be a door to the world of science.

Now Ferdinand Mueller wasn't particularly interested in social policy.

He was an opportunist, plain and simple!

He recruited kids, because they were enthusiastic and happy to wade through mud.

He recruited women, because he saw their talent going to waste.

In colonial times, they couldn't go to university. They couldn't enter the professions. But his project offered a glimpse of a world they longed to enter: a world where, in a different time, they would undoubtedly have thrived.

They proved they were worthy of far more: full and equal access with men, on merit.

Times have changed – and very much for the better, thanks in large part to those female pioneers.

But we still need those doors to science in the community.

We need to make them so bright, so bold and so compelling that everyone wants to walk through. And everyone who enters feels a magnetic attraction to stay.

Even if they gave up science in high school. Especially if they gave up science in high school!

The future belongs to all of us. The science that will shape it ought to be shared as well.

So Number Two: citizen science has to be a door to the world of science.

And Number Three, it has to make the world a better place.

In the end, that's what makes it worth doing.

It's all there in the letters that were written to Mueller, more than 150 years ago. Time and time again, these farmers' wives and stockmen's daughters speak of their pride to do something for Australia.

Remember the context. It's the 1800s.

It's the era of Banjo Paterson and Henry Lawson.

We're falling in love with our country.

There's even talk of Federation in the newspapers.

And here's a project that unites men and women from every colony, with a mighty vision, and a love of country.

We often focus on the "science" part of citizen science.

But the "citizen" is important as well.

It reminds us that we are part of something greater than ourselves.

And I think it spurs us to be part of making something better for the generations to come.

So there's my three criteria of citizen science:

- It has to be good science.
- It has to be a door to science.
- And it has to make the world a better place.

A project that ticks all three boxes will inspire talented people to succeed.

Now if we could go back in time, pick up Ferdinand Mueller in 1847, and drop him off at this conference... he'd probably collapse in shock.

But he'd get over it.

And he would ask the question at the heart of this conference: what's next for citizen science?

In the twenty-first century, what role will it play in the human quest for knowledge?

What place will it take in people's lives?

You can imagine two scenarios...

The first is that citizen science will be left in the twentieth century.

Robots and artificial intelligence will do more and more of the tasks that in the past could only be done by large numbers of humans.

For example: examining images from space telescopes. NASA is already using neural networks to trawl through a database of images from 150,000 stars, to catch the minuscule change in brightness that signals the presence of a planet.

Automated systems have been used before, but it's machine learning that's changing the game.

Now the machines are winning.

And in the same way, some people will tell you, all citizen scientists will be made redundant. And then all scientists. And then perhaps all humans.

Citizen science will be something we do for fun, not something we do because it makes a meaningful contribution.

That's scenario One.

The second scenario accepts that technology is changing, and so citizen science is changing as well.

But it's changing for the better: it's surging in the slipstream of technology, not falling behind.

On this reading, citizen science has never been more important, or alive.

That's the position of The Economist magazine – and say what you like about The Economist, it's not known for sentimentality.

The Economist calls the current moment “Punk Science”: brilliant technology plus resourceful humans.

At one end of the spectrum, you have tools that used to belong in high-end laboratories, such as fluorescence microscopes costing many tens of thousands of dollars. Now with a 3D printer from Aldi and downloadable plans from the University of Sussex you can make a fluorescence microscope to occupy pride of place in your home for less than \$500.

You can order a gene-editing kit online for a few hundred dollars.

You, the citizen, can do so much more – thanks to technology.

At the other end of the spectrum, people are still pretty good at knocking up low-tech tools.

There's a project in Canada: monitoring small plastic debris on the surface of the water.

When scientists collect this plastic debris they use special nets that cost \$5000 dollars. In the citizen science version, it's done with \$10 toddler's tights. Grab a plastic bottle as the mouth, slip over the tights, attach it to a boat, and there you go: DIY surface skimmer.

But now scientists and citizens are sharing these ideas, in the way that foodies share pictures of smashed avocado on Instagram.

It's a revolution dubbed "open-source hardware" by analogy with the "open-source software" revolution that has dominated both amateur and professional software development for more than twenty years.

A good idea goes so much further – again, thanks to technology.

I find scenario two far more compelling.

But here's the thing: it takes work.

It takes vision.

It takes creativity.

It takes strategy.

And it takes leadership...

Above all, it needs you.

Everything I know about human beings tells me that the Golden Age of citizen science is still ahead.

And we've come to Adelaide today because we agree.

170 years ago, a man named Ferdinand Mueller came to Adelaide with a dream.

Our mission today is to continue to live the dream.

THANK YOU