How will plant-based research help us overcome some of the greatest challenges of the 21st century?

I'm sure that at some point you've ambled through a park: sun shining, birds chirping, semi-naked yogi pulling ridiculous shapes over yonder – but I wonder how many times you've stopped and thought about the green scenery as anything more than pretty. Plants may not exactly be the wild partygoers of the tree of life, but we must owe them a little appreciation by now. Without them, after all, life wouldn't really be as we know it.

The fresh oxygen that fills our lungs, the mainstream medicines on which we're so dependent, the crunchy leaves in your salad – all stuff that we take for granted, and all made possible thanks to plants! If we hadn't had an agricultural revolution we'd still be scavenging berries and animal carcasses from the forest floor, and certainly wouldn't have the complex social structures we have today. Plants have done us proud so far, and there's currently heaps of plant-based research that aims to tackle many of the current problems we're facing as a race.

Nowadays people are living longer, which would be fantastic were it not for the increasing cases of cancer that go with age. The flavonoids are a group of chemicals found in almost all plants, particularly in Mediterranean foods. They have long been known for their antioxidant properties, and have been implicated in activating the body's anticancer responses[1]. Unfortunately cancer may never have a one-size-fits-all cure, so taking steps in your diet and lifestyle to minimise your risk is probably a not such a terrible idea.

The statistics for malaria are terrifying: 1.5 billion people are at risk, 500 million are infected, and an estimated 2 million are dying each year[2] – it's a massive global problem. Rather than relying on expensive prophylactics that are riddled with unpleasant side-effects, or carelessly tampering with delicate ecosystems, current research involving one of the parasite's essential components seems promising.

Figure 1: The anopheles mosquito is the vector for the malaria parasite

The malaria parasite's cells contain an apicoplast, which is very similar to the chloroplasts found in plant leaves[3]. Without a working apicoplast the parasite cells soon die, although the reasons are not fully understood. If we are able to get a better understanding of chloroplasts, then we could use this information to develop drugs that target the malaria apicoplast, and possibly have more effective cures with less negative side effects for the people being treated.

It's estimated that the human population is growing by two people every second, and by 2050 we'll have hit 9 billion worldwide[4]. Modern medicine aside, those people are going to need feeding. Sadly it's impossible to magically spring new farming land into existence – we're going to have to do more

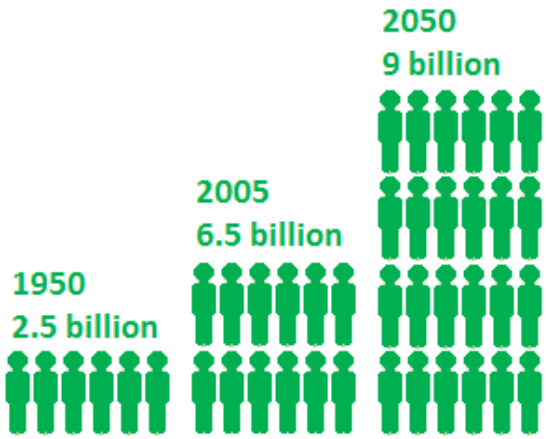

Figure 2: The World Bank's projected population figure for 2050

with less and feed more people per hectare, which could be doable through genetic engineering.

According to opinion polls GM crops are a little misunderstood by the public (likely thanks to a media hype jamboree), but within the scientific community the general consensus seems to be that the benefits are obvious and enormous, while the risks are based on speculation. By targeting genes in plants that increase crop yield or make them more tolerant to certain environmental conditions, we're basically just using faster, more efficient methods of our existing breeding strategies.

An estimated one million people died in the Great Famine of the mid-nineteenth century in Ireland, because of a fungus-like microorganism that infected potatoes with a disease known as potato blight. Nowadays such death tolls would be much less likely: fungicides are already being used to avoid a repeat of this scenario, and others have been and will be developed to defend against other diseases. By using these approaches we are ensuring that we obtain the crop yield that we need in order to feed our growing population.

Fuel prices in recent years have reached ridiculous new heights, and while the exact reasons may be dubious, one thing is for sure – we're running out of fossil fuels. Recently the Intergovernmental Panel on Climate Change released a paper confirming the possibility of overcoming our future energy crisis by using biofuels as a source[5], which not only produce fewer greenhouse gas emissions than fossil fuels, but are also renewable. While there are certainly some complications to overcome in developing such fuels, the future looks bright.

So it seems plant sciences could well help us to overcome some great challenges in the coming century, and the solutions illustrated here are just a few possibilities: with enough brains and manpower being thrown into this research field, there's little doubt that we'll be able to tackle greater problems by utilising our photosynthetic friends.

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