Diet, scams and the process of science

Colin Austin 20 June 2013

I started to write this article with the theme of compost tubes. The idea of a compost tube is very simple; replace the typical pipe system in a wicking bed with a porous compost path so the water flows through the compost feeding the plant roots with a rich compost tea.

I have been using this system for some time and found some good and bad features, so I thought this would make a good content for the Newsletter, but first I thought I should talk about why we should use a wicking bed for making compost rather than just simply adding mature compost to the soil.

The short answer is to encourage the phytochemicals which are so beneficial to our health but need the soil biology to release nutrients. Adding fresh or labile (easily changed) organic material provides the food for the soil biology which is a critical step in providing us with the valuable phytochemicals and trace minerals important for health.

A simple answer but since Xiulan (my wife) has suffered from diabetes I have taken to reading anything I can find about food and health. The literature on health product is so full of scams that I get really steamed up which has resulted in this newsletter changing from a simple talk on compost to a rant about how the scientific process is being hijacked in the unethical promotion of health products and what we can do about it.

A world of scams

It is a sorry story; there is a massive amount of advertising promoting weird and wonderful products, such as magic plants from Nepal or the Amazon jungle which are supposed to transform us back to vibrant teenagers. These adverts typically contain pictures of healthy young adults (often looking very sexy, probably actors) in a lab coat and claiming that this product is **scientifically proven**.

Now this gets me mad, employing a sexy youngster wearing a lab coat is not scientific proof. Even if we go to reputable scientific sources I find a spiders web of conflicting opinions, typically backed up by selected experimental data which happens to confirm that particular view.

For example ‘We can live a healthy life on a pure vegetarian diet, it is healthy to have a high protein diet, fat is not really all that bad for us with the real devil is sugar?’ All these and more views are held by respected scientific practitioners.

So what do we - as normal human beings concerned about our health, really decipher this confusion? The theme of how we need to interact with the scientific process has distracted me from the humble compost tube to look at.

The process of science

To take advantage of the scientific method we really need to understand the process of science and innovation.

Modern science is incredibly rigorous. The experimental process must be extremely rigorous, subject to peer review and independent testing before results are accepted.

Science has grown into a global trillion dollar operation, there are more scientist working now than in the entire history of science, the amount of data being collective defies imagination, well beyond the capacity of any one person to digest. With the advent of the Internet much of this information is widely available to the public (marred by the practise of the scientific publishing houses of not releasing research results to the general public, even though the research has almost exclusively paid for by public funds. But I better not get steamed up about that or I will lose the thread).

Data and scientific laws

Science and technology are not the same, science is concerned with understanding the basic laws of nature while technology is about developing practical devices or services. Let me explain further.

Let's look at an example from history to see how science works. There was a time when the early scientists were puzzled by how objects moved under the influence of gravity and forces. They were busy collecting a mass of data on the movement of bodies without any real understanding of how it all worked.

One of the classic problems that people we trying to understand was what happened when a man on a galloping horse dropped a ball. Did the ball just drop vertically? Experiment showed that this was not true but what path did the ball take, or more specifically how far would the ball travel from being dropped to hitting the ground? The collection of vast amounts of experimental data did nothing to resolve this problem, but when Newton introduced his laws of motion the solution was extremely simple.

The essence of science is analysing a mass of data to develop the fundamental laws of how nature works.

First was the recognition that velocity can be separated out into horizontal and vertical motions which can be analysed quite separately. The time it takes to drop to the ground is independent of the speed of the horse. It is easily calculated knowing the gravitational acceleration.

The distance covered by the ball is then easily calculated knowing the speed of the horse and the time before hitting the ground.

A problem which had baffled people for years and been subject to much investigation and collection of data was now readily solvable by the simple laws of motion.

The real world

The real world is typically more complex than the refined world of science. This is absolutely true in the case of diet, we have a good understanding at the level of basic science but there are many practical issues where we only have a limited understanding. We can manage this partial understanding by using empirical data or a working hypothesis.

Let's see how this works in the case of our dropping ball. Newton gave us the understanding to solve the basic problem but this does not include the complex issue of air resistance which will slow the ball so it will drop earlier than predicted by pure theory - how can we allow for that in our calculations?

The aerodynamics of a ball moving through the air is complex and cannot be analysed from pure theory so so we have to use a another technique of technology - the development of empirical relations, formulae which are not based on strict theory but are derived by analysing experimental results and fitting formulae which just happen to work - or a working hypothesis.

This is an extremely important part of applying technology; there are very few cases which science can predict without using empirical laws.

Empirical laws

But first let us modernise our problem updating this case to a Queensland yobbo who is converted to the cause of keeping Australia clean and instead of just tossing his can of FourX beer out of the car window wants to be able to toss it into a road side waste bin, naturally being a Queenslander he does not want to slow down but keeps on driving at 100 kph. How far does he have to be from the bin before he tosses?

An engineer may guess a working hypothesis to calculate the effect of air resistance. By instinct or gut feel she may guess that air resistance obeys a square law, doubling the speed increases the resistance four fold.

She can then go through a process of testing that hunch and modifying it until it gives a reliable prediction. This process of using a tested empirical formulae to design the jumbo jet or whatever with some degree of confidence or in our silly example tossing a can into a waste bin is not basic science - it is a basic tool of technology.

The ultimate test is - does it work?

Going bananas

It is very dangerous to apply scientific principles to complex practical problems without real world verification. I nearly burst a blood vessel in anger when I read in the general press reporting work on mycorrhizal fungi which basically said that it had been scientifically proven that increasing mycorrhizal fungi will actually increase the amount of carbon dioxide in the atmosphere.

It is absolutely true that reputable scientists had undertaken these tests varying mycorrhizal levels and measuring carbon dioxide levels which showed that atmospheric carbon levels actually increase with increasing mycorrhizal levels. This is probably an accurate report of the experimental data but only applies to the artificial conditions of this test.

But the **interpretation** in the press was absolutely wrong.

In any scientific experiment the aim is to minimise and control the variables so the test had been conducted in soil which had been sterilised so there were no other micro-organisms present so naturally increasing the level of mycorrhizal fungi would increase decomposition and hence increase the emission of carbon dioxide.

Of course fungi release some carbon dioxide, but bacteria emit much more so if we want to sequester carbon into the soil to improve its quality and help resolve global warming we need to encourage fungal decomposition (at the expense of bacterial decomposition) so a higher proportion of the organic material is decomposed by fungi rather than bacteria. This is exactly the opposite of what the press reported and no doubt the politicians and bureaucrats read. Very dangerous!

Soil is the second largest reservoir of carbon after the oceans and capturing carbon in the soil is the cheapest and most effective way of reducing atmospheric carbon dioxide. If you want to know why I went bananas you may like to look at my trilogy Resolving Climate Change Vol 1 Innovation in Soil Carbon Vol 2 The next great change Vol 3 How science can fail us (available on Kindle or on my web - $5 donation appreciated).

What shall I eat

We need to learn how to apply the same principles to our food when we choose what food to eat. Food science cannot give us the absolute answers so we need to 'manage' ignorance looking at all sources of information and developing a working hypothesis.

What should we eat for breakfast, lunch and dinner and in between so we can enjoy a long and healthy life. Sounds simple?

The chemical composition of the basic food groups, such as fats, protein, sugars, hydrocarbons etc. and the role they play in health are very well understood at the proven scientific level.

We also know that there are many other trace compounds that are essential for the body. They may only be needed in minute quantities and typically supplied by plant chemicals, phytochemicals.

For example we know that iodine is essential for brain function - the medical meaning of the word imbecile is associated with a lack of iodine. Normally this is supplied by plants absorbing minute quantities of iodine from the soil. Some soil have too low a level of iodine and imbecility is a common problem which can be readily resolved by supplements or soil additives.

On a happier not those delectable wines with their subtle flavours arise from the peculiarities of local soil conditions.

Naturally long lived societies

In China there is a little village where people live healthy and active lives into their nineties and even hundreds. Why science cannot answer. However testing of the water and local soil show an abundance of what we regard as the minor elements particularly selenium. This was the basis for my spoof thriller '00 and the soil princess' (which is available on Kindle books or from me, with a $5 donation).

Even more interesting is another society on a little Japanese island where again people have live long an active lives largely on a fish based diet. Of late some have adopted the western style of food with noticeable reduction in health. This indicates it really is diet and not genetics or some other reason.

The level of our fundamental knowledge is typically just not good enough for that so we have to rely on empirical knowledge e.g. knowledge which is not totally based on scientific understanding but which has been adequately tested in practise to know that it is a reliable tool - a working hypothesis.

Simply taking the results of scientific research without relating this to the complexities of the real world can be disastrous. Let me give you an example.

Laws of food

There are difficulties in with developing general laws of food (like Newtons laws), not only is the subject very complicated but we are all different. May be we should not wait for that magical universal truth but find out what food works for each of us.

I recently came across a very interesting piece of research; apparently there are two separate hormones which the body produces. The first tells us that we feel hungry, (so we need to eat) the second tells us that we feel full (so should stop eating). This is good quality research I certainly found the results surprising with major implications.

I had thought about it I would have guessed that there was just one chemical signal, like a fuel gauge in car gong from full to empty. Having two chemical signals could have dramatic implications.

We all react very differently to these hormones. Some people react very quickly to the 'full' hormone and stop eating before they become bloated so they tend to be thin, in other people the hormone level is quickly reduced so there is a desire to keep on eating and they get fat.

While food science may not be able to provide us with general laws on how any one individual should eat there is one area of science that has been incredibly successful, namely the development of taste additives. This is a multi-billion industry (which seems to prefer to adopt a low profile) supplying the processed food industry. Much of the processed food contains balanced proportions of fat, sugars, salt and taste

additives to make the food taste good which in turn would be anticipated to modify these hormones so many (but not all people) are encouraged to keep on eating.

Junk foods and the twin hormones

I was really excited by the fact that there are two hormones to control our eating. The idea struck me that the 'hungry' hormones may be able to sense that the body is not getting sufficient of these crucial trace components. As soon as the 'full' hormones have declined the 'hungry' hormones will be saying eat again.

Now I cannot run massive dual blind trials with thousands of people but I can do tests on myself. I know this is not science but what matters is the diet that is relevant to a particular individual, we are all different, so you may like to consider experimenting on yourself,

I am natural a pig and will just keep on eating until I feel full, naughty but nice. Give me a pizza and I will just munch away until I feel bloated. I assume that the feeling of being bloated is my 'full' hormone cutting in saying stop eating.

But a short time later I may find myself feeling hungry again and going back for that last piece. But I know that I have had more than enough to eat so why should I want to go back for more food. It is a reasonable working hypothesis that my hungry hormone sensor is telling my brain that I still haven't had all the **right** ingredients so go and eat again.

So instead of going back to for that last piece of pizza I tried eating some 'healthy' food like a piece of kiwi fruit before I felt full,. Sure enough I stopped having that nagging feeling to go and eat again.

Conclusions

So what do I conclude from all this - nothing in the sense of a strict scientific law. But I can say that as a working hypothesis that

- Trace elements in our diet our important for our health
- we can actually sense dietary deficiencies in our bodies
- eating even small amounts of food grown in healthy soil will improve our health
- minority elements are made more available to plants by an active soil biology diet.

So in the next newsletter I want to write more about our knowledge of soil biology.

For links goto www.waterright.com.au