bacteria, creates a vacant niche in the tiny ecosystem of the gut that is often filled by microbes different from those present before.

A poorly balanced diet can also lead to a change in the make-up of the bacterial flora. Too much protein, and *Escherichia coli* and species of *Clostridia* may dominate, metabolising protein to unpleasant, foul-smelling, and toxic compounds like ammonia and phenol.

Research has shown that two common inhabitants of the human gut, *Lactobacillus acidophilus* and species of *Bifidobacterium*, may be able to exclude less desirable microbes and so help maintain a balanced intestinal flora. They occur naturally in various foodstuffs, but processing tends to remove them.

For example, the pasteurisation of milk, introduced mainly to kill the bacteria that cause brucellosis (a disease of cows that also affects humans), means that modern milk contains few if any of the beneficial bacteria either. However, certain spore-forming bacteria survive pasteurisation, and they will eventually turn unopened milk bad. These bacteria do not help us digest milk, but *L. acidophilus* does.

Plenty of adults cannot drink milk in any quantity because they have a 'reaction' to it. This may take the form of abdominal cramps and bloating, flatulence, and diarrhoea. The condition is often caused by a deficiency in adults of the enzyme lactase, which breaks down the natural sugar in milk, lactose.

Without the enzyme, the lactose will continue through into the colon where various bacteria will ferment it into fatty acids and gases. The presence in the bowel of the sugar and its fermentation products has an osmotic effect, causing water to be retained, hence the bloating and diarrhoea.

Lactase deficiency is rarely found in babies, but levels of the enzyme commonly decrease after weaning, as is the case in all other mammals. In adults of some races, low lactase levels exist throughout the population; but only 5–20% of Caucasian adults have the condition.

Lactose-intolerance is not the only problem; reactions to milk may also be caused by breakdown of milk proteins by unhelpful gut bacteria, and genuine allergy to milk proteins can occur. Now, however, a type of milk has been devised that will help with these problems, except the allergy. (The only solution to a genuine food allergy is to eliminate the offending article.)

The new milk, called Revital®, is a pleasing example of the collaboration between science and industry. Dr Ron Hull of the Dairy Research Laboratory in the CSIRO Division of Food Processing helped in the development and launch of the product in Victoria.

What is special about Revital® is the presence of two types of deliberately introduced bacteria — *Lactobacillus acidophilus* and the *Bifidobacterium* species. Together, they can digest milk proteins and lactose.

Not only do they help us digest the product that is their home, they can also discourage less helpful bacteria, such as spore-formers, from proliferating in the foodstuff. What's more, the food acts to 'top up' the colonies of the two useful species inside us, keeping our personal bacterial flora of the best type.

Dr Hull believes that the type of milk that adults should be consuming is cultured milk — which until now has meant yoghurts containing *L. acidophilus*, a product that he has also studied. These have a sour taste, but Revital® does not — it is just like fresh full-cream milk.

Revital® should soon be on sale throughout the rest of the country. Dr Hull believes that in the future helpful digestive bacteria will also be added to fruit juices and other foodstuffs that are kept refrigerated. This already happens in some other countries. So have a drink and enjoy your bacteria!

Roger Beckmann

Survival of *Lactobacillus acidophilus* in yoghurt. R.R. Hull, A.V. Roberts, and J.J. Mayes. *The Australian Journal of Dairy Technology*, 1984, **39**, 164–6.

Going for green

In city traffic, nothing uses up fuel and patience quicker than frequent stopping and starting. But, since November 1987, drivers travelling down a 10-km stretch of Canterbury Road in Melbourne have been encouraged to save both.

A series of computer-controlled advisory signs provides the encouragement: motorists who choose to travel at the recommended speeds can catch a sequence of green lights.

The signs are the visible part of ADVISE (Advisory Display of Variable Information for Speed and Economy), a project funded by the National Energy Research Development and Demonstration Council and carried out by the CSIRO Division of Building, Construction and Engineering in collaboration with the Roads Corporation of Victoria (VIC ROADS).

Using data from the VIC ROADS' computer-controlled traffic-signal

The green light — ADVISE means more of them.

A research vehicle plying the test route, fitted with a computer and driven exactly at the recommended speeds, recorded a 9% fuel saving.

In a user survey, 90% of drivers said that they changed their speed or drove more carefully in response to the signs.

co-ordination network, the ADVISE computer predicts the timing of future signals and the length of traffic queues, calculates the speed at which vehicles need to travel if they are to reach the next traffic light while it is green, and relays this information to a series of electronic signs positioned every 500 metres or so along the road.

The signs display information about traffic density and the length of road ahead that will have green signals if the vehicle travels at the recommended speed.

According to Mr Ros Trayford and Mr Mike Wooldridge, the two CSIRO scientists who have been with the project since its inception in 1978, its impetus came from the oil crisis of the 1970s. At that time, if you remember, the big jump in fuel prices seemed to herald the end of the V8 and a surge of interest in energy conservation.

ADVISE was part of a broader program set up by CSIRO's Division of Energy Technology (now part of Building, Construction and Engineering) to examine alternative ways of conserving the energy used by passenger vehicles. Despite bigger cars coming back into vogue in the latter half of the 1980s as the urgency to conserve energy subsided, the ADVISE project continued.

After the first year's operation of the Canterbury Road system, ADVISE data show that smoother traffic flow saved motorists 3–4% of their fuel, while a test car fitted with a computer and complying exactly with the signs saved 9%.

At a time when the Gippsland Basin oil-fields are providing Australia with 70% of our crude oil needs, these energy savings may not seem large. But things may seem different in the year 2000 — only a decade away now — when the Basin is likely to provide less than 30%.

Nevertheless, at current fuel prices of about 50 cents per litre and assuming that the average vehicle uses one litre of fuel on the 10-km ADVISE section, the saving in annual fuel cost exceeds $200 000. A further $300 000 is saved through reduced car maintenance, estimated at 3 ¢ per stop.

Given that annual maintenance of the ADVISE system costs about $25 000 and its installation under $300 000, the cost–benefit ratio is quite high.

The system is popular, too. A recent survey commissioned by the project team shows that Melbourne drivers appreciate the advice given by the signs. Opinions collected from a random sample of the route's users (800 telephone and 300 household interviews) showed that a large majority (90%) favoured ADVISE, found it of value, and said that they changed their speed or drove more carefully in response to the system.

Whether future Melbourne drivers will see more of their arterial roads with ADVISE signs will depend largely on the VIC ROADS' evaluation of the Canterbury Road trial. As *Ecos* goes to press, the Corporation is examining the first year's results along with more recent data as they come to hand.

Although the future of ADVISE in Melbourne is still uncertain, the CSIRO project team is confident that growing traffic congestion in the world's cities will ensure a ready market for its expertise at getting information to drivers and encouraging smoother traffic flows.

The team is about to become 'Dynamic Transport Management Pty Ltd' — a company in which CSIRO will

have equity. In the years ahead, the company will not only help city drivers around the world catch more green lights but will assist road-system managers and road-users in several other ways.

It plans to work with city authorities to install integrated traffic and information systems using the latest computer-based control, information, and communication technology. As well as giving drivers advice on optimum speed and route, the systems will be able to locate stolen vehicles, reduce congestion, automate despatching for couriers and taxi operators, and speed the movement of emergency transport.

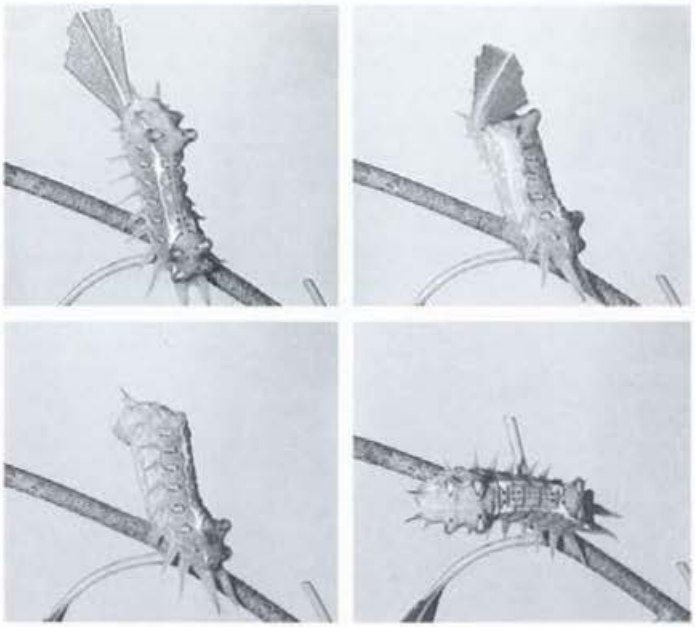
David Brett

Response and attitudes of the public after one year of ADVISE dynamic signs. R.S. Trayford, T.B. Crowle, and J. Graves. *14th Australasian Transport Research Forum, Perth, W.A., September 1989.*

Insect outwits tree?

Plants and the insects that eat them have been 'at war' for aeons. Although the plants may sometimes seem to be struggling (for example, when trees lose all their leaves to Christmas beetles), many fight back by producing toxic or at least digestion-inhibiting compounds in their leaves.

A step more refined than this is the chemical defence that is actually 'switched on' by the insects' attack. Such induced defences have recently been demonstrated in several species of deciduous and coniferous trees. Nobody yet knows whether our native trees, the eucalypts, are similarly gifted, but some interesting observations by Dr Penny Edwards of the CSIRO Division of Entomology have suggested that they may well be.



A larva of the cup moth, *Doratifera oxleyi*, feeds on a eucalypt leaf and then removes the half-eaten leaf. The third picture shows it chewing the remaining stump; finally it moves away to find another leaf.

She and her colleague Mr Wolfgang Wanjura observed a number of different insect larvae 'cutting off' the eucalypt leaves on which they had been feeding.

All the insect species involved showed remarkably similar behaviour. After feeding on a leaf for an hour or more, the larva moved to the stem and started to chew at the petiole or leaf-stalk, at the base of the leaf. Eventually the leaf fell off. Then, curiously, the larva continued to chew at the stump on the stem for several minutes before heading off to find another leaf.

If the insect was disturbed it appeared unwilling to leave the task uncompleted, for it returned to the job rather than departing to find a new leaf.

The larvae of sawflies often feed together in a clump on one leaf; Dr Edwards found that when a group moved from a leaf the last larva to leave carried out the cut.

Now, this leaf-cutting behaviour has occasionally been observed on other species of plants overseas. A fairly obvious explanation for it is that damaged leaves could 'give away' the insects' presence to predators or even parasitic wasps seeking clues to the whereabouts of potential hosts in which to lay their eggs.

But Dr Edwards has a convincing case for a completely different explanation. She believes that, by removing the leaf upon which they have been feeding, the insects are sabotaging an induced defence in the tree.

Usually, induced defence works like this: the damage to the tissues brought about by insect feeding causes the release of a chemical that is thought to diffuse from the leaf to neighbouring leaves, which respond by increasing their levels of toxic or repellent compounds.

By cutting off the leaf before a certain time has elapsed, the larvae prevent the signal from getting through. They can then feed in safety upon another nearby leaf of the same plant.

Evidence for this idea comes from the observation that most of the insect species involved do not always carry out these actions; the variation may depend on the host plant. If the behaviour were providing protection from parasites and predators, the pressure of natural selection would most likely have ensured that it was always performed, but clearly if at times the plant produces little or no induced response and the insect can detect this, then the behaviour is not necessary.

Moreover, several of the species that pursue this habit don't seem to be trying to hide themselves from anyone — they may be conspicuously coloured, or already have

SIRODIAL

A new telephone information service from CSIRO is up and running. Called SIRODIAL, it provides instant, accurate information on 25 topics that people frequently ask CSIRO about.

SIRODIAL is inexpensive: a call from anywhere in Australia costs about 50 cents per minute and most calls last about 3 minutes. And the information it offers is always up-to-date.

Some of the topics covered, and the numbers to dial to hear about them, are:

the ozone hole	00 555 2183
greenhouse effect	00 555 2132
land degradation	00 555 2175
composting	00 555 2173
earthworms	00 555 2174
food additives	00 555 2179
astronomy news	00 555 2182
termites	00 555 2170

For the complete 'menu' of topics phone 00 555 0300, or phone 008 023347 for a brochure listing all topics and the numbers to dial.