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## ***What is killing the frogs? - A reply to last week's talk***

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Last week on this program **Barrie Oldfield** looked at the decline of frog populations and suggested that electro magnetic radiation and mobile phones may play a role in their demise. Today, Professor **Rodney Croft**, Executive Director of the Australian Centre for Radiofrequency Bioeffects Research, responds to last week's talk and tells us of his research in this area.

### **Transcript**

This transcript was typed from a recording of the program. The ABC cannot guarantee its complete accuracy because of the possibility of mishearing and occasional difficulty in identifying speakers.

**Robyn Williams:** Well last week we did something a little unusual for this program: we ran a speculation about what's killing frogs. Millions of these beguiling creatures are being wiped out around the world. Most scientists blame the chytrid fungus, once carried on an African frog used for pregnancy testing way back. The frog was exported around the world, along with the disease from which it was largely immune, and then, presumably, a few of these original frogs escaped or were let loose, spreading the infection to vulnerable species. That's the orthodox explanation.

Barrie Oldfield, from Perth, actually blames the microwave effect instead. He suggests that the ubiquitous radio waves coming from our various devices, are frying the frogs' very molecules. Here's what he said last week.

**Barrie Oldfield:** Now consider the microwave oven again. It cooks the food by exciting water molecules with electro-magnetic radiation. So let's think of frogs. I think you'll have got my drift by now. Frogs are one of the most aqueous creatures on the planet. All frogs have a higher content of water than the average animal. Further, they depend upon their wet skin for survival. . All frogs have a higher content of water than the average animal. Further, they depend upon their wet skin for survival. Some frogs such as our own Water Holding Frog, *Cyclorana platycephalus*, can survive long periods under hyper-arid conditions simply because they wear a wet suit; their outer skin traps water against their inner skin.

It follows therefore that the frog is the most prone of all animals to the adverse effect of electromagnetic radiation. We are quite literally microwaving them with our mobile phones and everything else that emits EMR in order to operate. One might think that fish being the wettest of all creatures would suffer first. Well they swim around in a relatively large mass of water and just as the forest shields your car radio from EMR, so fish are protected by the very water of their environment.

As I've mentioned, some EMR has always been around, of course. It's the very stuff that the Sun sends out to warm the Earth, excite the chlorophyll in plant leaves, and thereby lay the foundation for energising life on this planet. But solar energy comes in surges one day apart, and in the interval of night the ether waves are almost silent. Well they were until James Clark-Maxwell, Heinrich Hertz, and Guglielmo Marconi gave us this fantastic means of communication. Now we have 'electrosmog' day and night, all over the world. There is no quiet time and no really quiet place any more.

There will always be debate on the level of radiation which might be considered safe. There will also be those who contend that all radiation brought into being through the agency of man is dangerous insofar that evolution has had no time to adapt our living organisms to it in this short period of history.

I wonder why we assume that there is never a downside to all our wonderful technologies. If a frog would only hop on my shoulder and whisper in my ear, would it tell me that the strange zizzing sensation under its skin has left it impotent?

It might also tell me to keep away from Compact Fluorescent Lamps, at least until their EMR has been eliminated.

**Robyn Williams:** Barrie Oldfield. In fact Professor Valerie Beral, the Australian Professor at Oxford, did once propose that fluorescent lights in offices might be linked to skin melanomas. But that's gone quiet. What about Barrie Oldfield's general case though? Professor Rodney Croft is Executive Director of the Centre for Radiofrequency Bioeffects Research and Professor of Cognitive Neuroscience at Swinburne University of Technology in Melbourne.

**Rodney Croft:** As an Australian scientist actively researching the issue of electromagnetic radiation and health, I am particularly interested in what Barrie Oldfield has to say.

In terms of the physics, it is true that we do have radiofrequency energy around us just about all the time, and as this energy is absorbed by water molecules, frogs, humans, anything else that has water molecules accessible to the radiofrequency energy, will absorb energy.

It is also correct that the absorption of electromagnetic energy (which is often called such things as EMR or EME) is not a new phenomenon, but rather something that has been around since life began on this planet, and so the issue is really whether this particular

type of electromagnetic energy causes a problem. We're happy that we understand many other forms of electromagnetic energy, but it is certainly appropriate to want to clarify whether the radiofrequency band used in telecommunications is a problem for us.

However, this is not something that has been overlooked by the scientific community. The National Health and Medical Research Council of Australia recently formed a Centre of Research Excellence to address this very issue. This is the Australian Centre for Radiofrequency Bioeffects Research (or ACRBR as we call it), and as the Director of this Centre I not only research this area myself, but also monitor the international research effort. So I thought it would be worth giving you an idea of where the science is presently at.

The research effort spans many domains. Even just here in Australia we have groups looking at everything from the measurement and modelling of the energy that is absorbed by animals and humans, to research that gives very high level exposures to mouse foetuses and new-borns, and looks for changes in brain function, to a study following a group of teenagers to see whether there are any relations between their mobile phone use and a number of thought processes. Internationally the main additional area being researched is the possibility of a link between mobile phone use and brain tumours, and Australian researchers also play a role in this international collaboration.

In general though, there have not been any health effects shown. Sometimes there are reports of health effects, but when these have been tested by independent labs it has always turned out that there was nothing there. This is normal in science of course, as no one study is capable of proving anything because of statistical issues, and we need to look at the research effort as a whole to determine what is going on. Certainly there are some interesting findings out there, and in fact our Centre has recently published reports of effects of mobile phone exposure on brain function, but none of these have so far related to health.

So there has been extensive research both in Australia and broad, and this has failed to find any effects of mobile phones and their resultant electromagnetic emissions on health. But I guess there are two things that Mr Oldfield brings up that this does not address. That is, I have been talking about mobile phones as opposed to more general electromagnetic emissions, and I have been talking about research into a number of species, but not frogs specifically.

In terms of more general electromagnetic emissions, such as that emitted by your baby monitor or from mobile phone base stations, I remember being quite amazed by the kind of demonstration that Mr Oldfield presented. For me it was the interference caused by a mobile phone in stand-by mode, which on average emits only tiny electromagnetic emissions, on my personal computer. The screen flickered and the computer's speakers emitted a loud buzz (I had the volume turned up), and I remember how seeing and hearing that made me feel that the mobile phone emissions must be strong and doing something quite dramatic. The fact of the matter though was quite the opposite, and it

was really just that the computer circuitry is amazingly sensitive, and that the monitor and speakers were merely amplifying a very small signal.

It is the same with Mr Oldfield's electromagnetic radiation detector, which is sensitive to extremely small emissions, which our body is not. We do tend to believe what we see (or in this case hear), but many precise measurements have been made to determine the level in the environment, and it is now clear that the radiofrequency energy around us is extremely small, and far smaller than what we use in our experiments. Now it is important to note that as less radiofrequency energy results in less heating, and as the levels in the environment are far smaller than what we use in our experiments, that our research is really a worst case scenario, which means that if there was an effect of environmental electromagnetic emissions, then we would certainly see it with the higher levels used for research. So given that we haven't found any health effects in our experiments, it is hard to imagine how the tiny electromagnetic emissions in the environment could cause a problem.

In terms of frogs, Mr Oldfield is correct in pointing out that they will absorb a larger proportion of electromagnetic energy because of their high water content. However, even though this is a larger proportion than many other species, the total amount of energy absorbed is still extremely small, and far less than what other species have been exposed to in the research that I've described. In fact it may be worth pointing out just how small these exposures are. For instance, the energy that the frog in the rainforest will pick up due to the radiofrequency transmissions, will be many millions of times smaller than the energy produced by the environment or the metabolic activity of the frog itself, which is again much smaller than what we use in the lab. So although mice may absorb a smaller proportion of energy than frogs, those mice tested experimentally have absorbed much, much more electromagnetic emissions than frogs would in the environment. So frogs will still absorb extremely low levels and there is no reason to believe that they might be affected by radiofrequency energy, even if they do contain a high proportion of water in their bodies.

So why have frogs reduced so dramatically in numbers then? Well looking at the debate internationally, there is clearly no consensus on the issue. However, when we look at it from another angle, while it is true that we don't know what is causing the global decline, it is also true that we do know of a number of things that do kill frogs.

Habitat destruction and fragmentation are clear causes of frog mortality, as are non-native predators such as cats and trout. Chemical pollutants have been shown to cause dramatic changes in tadpoles, ranging from the growth of extra limbs, to feminisation. Ozone depletion is yet another cause, with frogs unable to adapt to the higher levels of ultra-violet-B radiation that they're exposed to these days, and recent extinctions of particular frog species, in both Australia and North America, have been shown to result from a disease called chytridiomycosis, a chytrid fungus that has been here since the 1970s.

This means that although there is no consensus as to why frogs are dying out in large numbers, we at least have strong science that shows how particular environmental factors

can affect individual frogs, with scientists trying to build up an adequate explanation of the large scale decline from that knowledge-base. It is not the same though when it comes to radiofrequency energy, as we don't even have evidence that it can affect the health of one individual frog (or mouse, or human for that matter), and thus we don't even have a starting point with which to build on, and no chance of using this to help explain the population decline in frogs.

So while I certainly agree with Mr Oldfield in many of his scientific details, and his encouragement of people to take a more active involvement in caring for their environment, there isn't any reason to believe that frogs will be more affected than, say humans, or mice, by the radiofrequency energy in the environment, and there is certainly no indication that humans or mice have anything to worry about here.

**Robyn Williams:** Rodney Croft is Professor of Cognitive Neuroscience at Swinburne University of Technology and Executive Director of the Australian Centre for Radiofrequency Bioeffects Research. And we shall continue to keep tabs on what they find.

And my thanks to Ruth Beran of *Catalyst*, on ABC Television for help with today's program.

Next week, Keith Suter reflects on the five years that have passed since the great museum in Baghdad was trashed.

I'm Robyn Williams.

## Guests

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## Further Information

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