

The Role of Carers In Disease Surveillance and Frog Conservation by Deborah Pergolotti, Founding President, Frog Decline Reversal Project, Inc. (T/A the Cairns Frog Hospital) P. O. Box 2731, Cairns, FNQ 4870 [www.fdrproject.org.au](http://www.fdrproject.org.au)

It's Just A Frog!

When I was a kid in school, boys used to find frogs during recess and tossed them around and brutalised them until they died. There was no reason for this other than a total disregard for what was a sentient animal - it was cold blooded and that seemed to be excuse enough to kill it. There was an imaginary line in the sand and some animals were obviously above it and others below. In some people's minds, frogs are still below that line and, when they find one in distress, they walk past it and forget about it.

Thankfully, however, attitudes are changing and many people realise that even small animals that aren't warm and fuzzy are still a valid part of the picture and need to be treated the same way as a koala or a curlew or a possum. More and more, frogs are turning up on the wildlife rescue carer's doorstep - but are they being received?

When I joined the local wildlife rescue group in 1998 and told them I wanted to look after frogs, they said, "we don't do frogs - there's no call for it". I was insistant that frogs were all I was going to 'do' and that was that. Within weeks, I had three in care. Within three months, I had fifteen in care. At the time of writing, I have about 150 in care.

Back in 1998, information about frog care and rehabilitation did not even exist. The Cairns Frog Hospital is trying to fill that void and, in doing so, we have also uncovered some serious frog decline issues that carers need to be informed of if they are to start receiving frogs.

Why is Frog Rescue Important?

Amphibians are a very important part of the food chain. They are preyed upon during all of their life stages (as eggs, tadpoles and frogs) by a variety of animals including fish, reptiles (especially snakes), and birds. They may well be taken by other creatures too, as documented by marine conservationist Neville Coleman, who has shown me his photographs of a very large grasshopper that caught and consumed a small frog.

Frogs also consume items further down the chain from themselves, in particular - the insects. Insects make up the largest biomass on the planet and frogs help to keep them from devouring all the vegetation on the planet.

In recent decades, frogs have also been singled out for the honor of being considered "environmental indicators", which means they have a social value as an early warning system for us. Their biology makes them a ready sponge for any pollutant or pathogen which comes along to subtly influence their habitat. They react negatively to these influences faster than other animals. In the modern world of humans

first-planet last, this is a distinct disadvantage for the poor frog, and declines around the globe are being discovered and studied.

In the sense of receiving frogs for care and rehabilitation, there are many benefits:

- \* opens a window of information as to what is actually happening to frogs in the bush or suburbia
- \* helps identify threats that previously remained hidden through lack of exposure
- \* allows the carer to have 'hands on' opportunity to learn and practice setup and care techniques which might be slightly different for each species
- \* allows the carer to be an active participant in wildlife disease surveillance
- \* gives the carer skills which can be applied towards saving endangered species
- \* provides the public with an opportunity to be helpful to wildlife
- \* raises public awareness of the importance of frogs and how to help them
- \* important conservation tool as species start to decline

"Rehabbing Frogs is a Waste of Resources When They Breed so Prolifically"

Not anymore. It is true that frogs produce large numbers of eggs but it is to compensate for high mortality rates that they do this. In normal conditions, only a small percentage of larvae will survive long enough to metamorph. But the frog decline scenarios in progress are far outweighing the frogs' reproductive rates. For example, the Green and Golden Bell frog (*Litoria aurea*) is perhaps Australia's most prolific frog with clutch sizes up to 7,000 eggs per spawning. With a production rate like that, they should be a plague upon the landscape but they are not. They are endangered and have been reduced from all of the NSW coast to a half dozen small sites.

The other aspect is the speed with which an emerging disease can take a very common species and turn it into a very endangered one in just the span of a few months. This is what happened to nearly a dozen species in Australia when chytrid fungus first arrived. No frog species in Australia can be considered secure - and that's before the additional threats of climate change, fire, and international conflicts are even considered.

What Can You Do For an Injured Frog?

As defenseless as frogs are, they have amazing recuperative abilities ... if they get a little help! An injured frog left in the wild will usually not last very long. It will be taken by predators or die from infection. But an injured frog taken into care can be rapidly healed from a variety of injuries and returned to the wild to live again and hopefully reproduce in the next breeding season. (Please note that NSW does not allow rehabbed frogs to be released to the wild after care - they must be transferred to licenced recreational keepers.)

We receive calls from vets and carers around the country to ask if they should do anything for a frog that has just come in with a broken leg,

attacked by a cat, or a missing limb or a damaged eye. The answer in all cases is yes. A broken leg can be fixed. So can gashes, punctures from a snake bite, some burns, eye infections, being crushed in a door or cut while squeezing through a fence. There are only a few injuries which are not so fixable.

If both eyes are permanently damaged, then euthanasia is sadly required. Even captivity is not a suitable outcome for a blind frog. We usually give frogs a few weeks of care to see how much clearing takes place in the eyes before making a decision to terminate, but we are in a severe decline in this area and make every effort to save every frog that comes in.

Spinal injuries which occur in the head or shoulder blade area tend to cause the head to tilt on an angle. This seldom repairs and euthanasia is recommended. However, some spinal injuries lower on the back can heal. If the frog does not regain proper use of both back legs after a period in care, then the decision can be made to euthanize or transfer to a keeper.

A missing back leg is easily compensated for by frogs and they can still jump well. However, if a front leg is amputated beyond the elbow joint, return to the wild is not suggested. Such frogs (depending on the species) would be better suited to a pampered life in captivity. If the amputation is at wrist level, then the frog can learn to lean on the stump and return to the wild, but it might take many months of care first. A total amputation up to the shoulder is likely to require euthanasia.

To understand why the front legs are such an issue, try walking around the floor on your hands and knees. Now bring one arm up behind your back and walk. How many times did you fall on your face? Bring the 'disabled' arm down and bend it so that you are leaning on the elbow joint and try walking again. Still doesn't work so well, does it?

Many people will become distressed at seeing a frog being eaten by a snake and rescue the frog. While this is part of natural predation, it is disturbing to watch and, in the case of the local Green Tree Snake, can be a futile waste of a large frog. Green Tree snakes do not distinguish between what is a suitable size meal and what is physically impossible for them to eat. They will attack large frogs that will not be eaten but will be substantially injured before the snake gives up. Even when internal organs such as a lung or part of the colon protrude from a fang puncture, they can be retracted and the hole heals over.

Frogs unfortunately get burned sometimes through hot water scalding, chemical splashes, sunburn and heat sources such as BBQ's and clothes dryers. The type of burn and where on the body it occurs will determine if euthanasia is kinder than treatment, but burns are not necessarily a death sentence although they do require fast, intensive care.

Another injury that results from being stepped on or digestion problems is the prolapsed vent, where the colon or bladder is forced out of the vent. This is fixable via surgery but requires immediate attention by a vet. Bacterial infection is a usual complication because of the exposure of raw tissues.

## Diseases Can be Overlooked

If you are not expecting sick frogs in your area, you may not realise that the injured frog that just arrived could also be sick. Once a frog's protective skin barrier has been breached by scratches, ulcers or injury, the frog immediately starts to absorb bacteria and fungi from the environment. Any frog that has experienced damage to the skin more than 24 hours before it was brought in for care can be assumed to be harbouring an early bacteria infection. Any sign of pale blotches or spots in the skin is a sure indication of an infection and antibiotics are essential.

But there are other pathogens out there in many parts of the country and overseas that can wipe out large numbers of frogs. In southern Australia and up the east coast, the dreaded chytrid fungus has had such an impact on frog populations that it has caused the total disappearance of entire species. Here in Far North Queensland, we are researching the identity of several new disease problems. Any carer that receives a frog anywhere in Australia could be receiving frogs that are affected by or carrying pathogens. Therefore, it is prudent to treat all frogs arriving as potentially contagious and use procedures accordingly.

This does not mean that you have to establish a lab at home to accommodate Bubonic Plague! But using disposable gloves for frogs you handle is a good start. Using bathing trays once and then washing them according to proper disinfection is another. Frogs need to be housed one per tank. Frogs should be kept in a different room from other animals being looked after and, if you are going to be routinely caring for frogs, it would be a good idea not to also take in any other reptiles. This is to prevent any contagious pathogens in the frogs from infecting other cold blooded animals and vice versa.

Becoming aware of the possible disease problems in your area will allow you to be prepared for handling those cases, but it will also enable you to participate in the nationwide effort to watch for new and emerging wildlife disease problems. By sharing information about the types of problems the frogs in your area have, this will help scientific researchers understand these diseases better and how they are getting around.

## How Would You Know a Frog Is Diseased?

One of the ways frogs make things complicated for us in this regard is that each species could show slightly different symptoms although they might have the same illness. The other difficulty is that frogs have a limited physical structure which makes the display of symptoms less diverse. In other words, there are only so many ways that a frog can demonstrate an illness, so one symptom could represent several different problems.

For example: a frog may arrive with open sores or lesions. It depends on the shape and location of the ulcers as to what their cause is. If you don't know what caused them, you might not use the correct treatment and the frog will die.

If the ulcers are a variety of sizes, very clean edges, the muscle tissue seen through them is red, and most of the larger ulcers are on the underside of the body, then these are fungal. However, if the ulcers are smaller, all are located on the lower back or thighs, and the frog also has fluid retention and swelling in one leg, then they are caused by the *Spirometra* tapeworm. The fungal ulcers require Multicure (an aquarium antifungal) while the *Spirometra* ulcers require Praziquantal (a tapeworm tablet used on cats and dogs). The symptom is ulcers but the causes and treatments are vastly different.

Ulcers can also be caused by chytrid fungus, bacterial infection, flesh eating fungi and bacteria, *Mucor amphibiorum* (a soil fungus disease), the new respiratory disease we are researching, and injuries such as chemical burns or animal attack.

There are many specific ways to know if a frog is sick and some of those are physical signs and others are behavioural. If you have the opportunity to ask the finder of the frog questions, then you will access valuable clues as to what has happened to the frog and what might be going on with its health. One of the first ways to know if a frog is ill, regardless of how good the body might look, is when the frog is found sitting in an open, exposed area during the day. This is an early sign that the frog is not well and other symptoms will soon appear.

Some people will turn a frog over on its back and if it has difficulty righting itself, then it is ill. This is pretty reliable. If you are familiar with what the species look like in your area, this will be very helpful since some of the signs of illness are based on changes in the appearance of the skin or body weight. If you don't know what your local species are supposed to look like normally, you won't be able to tell when something is abnormal. This is a list of some typical symptoms:

weight loss as shown by loose skin or spinal detail  
changes in overall skin colour to too dark or too pale  
pale fuzzy spots in the skin on the back  
ulcers anywhere on the body  
discoloured feet  
excessive skin secretions such as slime on the body  
excessive sloughing of the cuticle coating on the skin, especially on the legs and feet, which appears as dried stringy bits which collect dirt  
black patches on the skin a 'wear and tear' appearance to the skin  
fluid retention anywhere in the body  
coordination and hopping difficulties  
pupils do not react properly to light  
shallow constant panting seen in the abdominal area  
lethargic behaviour  
no interest in food  
spending excessive amounts of time in water

Some symptoms that appear are actually connected to injuries such as:

a milky exudate on the back of the head or shoulder area (poisoning)  
extreme swelling in the abdomen (head, spinal impact or poisoning but also a possible sign of bacterial infection if the swelling is fluid and not air)  
air balloons under the skin anywhere on the body (the frog's equivalent of our bruise marks - frogs retain air in their lymph sacs when impacted)  
cloudy eyes and/or nictitating membranes (the clear shield that comes up over the eyes when the frog is

sleeping) (poisoning) patches of a sky blue skin colour on an otherwise green frog (poisoning is currently suspected) head tilts on a sideways angle (upper spinal injury but could also be brain infiltration from parasites)

#### What Are the Currently Known Disease Issues in Australia?

If what we've seen in local frogs is any guide, just about anything can pop up anywhere. When something new comes along, it takes a while to pinpoint that it is different from what you know. Some of the identifiable problems are described here but if a sick frog arrives and the symptoms are not consistent with those described below, then it might be something else we haven't seen in our region. It is always useful to ensure a frog that dies from something other than an injury is preserved and sent to a lab for testing.

By keeping careful records and a watchful eye over a frog's behaviour and physical appearance, you can collect information which can be used to identify when a new problem becomes active in your area. By contacting researchers or us, you can be an active participant in the disease surveillance effort.

#### Chytrid fungus

Chytrid fungus is very well publicised and has turned up in a large part of the country with some specific exceptions. Chytrid is temperature dependent and prefers a growing range of 15 to 23 degrees. It is active during the winter months and can be active outside that season if the location remains cool such as high altitude areas. It has not been found in the Northern Territory, Tasmania (which puzzles researchers) or the tropical lowland coast of NQ and Cape York. It does occur in the high altitude Wet Tropics however and has devastated species there.

Chytrid is almost always fatal to frogs and toads and is highly contagious. It attacks the skin on the feet and underside of the body but becomes systemic in some way to cause the victim's death within three weeks of onset. Symptoms are vague for this disease but sometimes a frog will exhibit fluid retention in the legs and a red flush on the underside of the body (the ventral surface). The usual indications of its presence are numbers of dead frogs and toads being found, especially floating in water or nearby.

Although successful treatment of chytrid in Australian species has not been perfected yet, the fungus itself is extremely easy to disinfect. Simple disinfectant with hot water can be used to wash all tanks and utensils being used for the frogs. Rinse well and towel dry. Chytrid is aquatic so the biggest handling issue is making sure no moisture from a contaminated enclosure can reach another enclosure.

#### Bacterial infections

These problems are common, especially in captive collections and animals which have been injured. "Red leg" is a well known one caused by the gram negative bacteria *Aeromonas hydrophilla*. Symptoms can include a pinky red flush on the underside of the thighs and vent area, ulcers anywhere on the ventral surface or sides of the body, blood

seeping through the pores on the feet, and increased sloughing and sliming. Antibiotics and antibacterial baths are used to treat the infection. *Aeromonas* is highly contagious and airborne so infected frogs should be isolated from other animals. Disinfection by washing in bleach and rinsing very well will rid tanks and utensils of the pathogen.

Other types of internal bacterial infections can appear as pale fuzzy spots on the back of the frog. A frog who appears to have 'black veins' or has a foul smell to it has septicemia (bacterial blood poisoning) and, by the time these symptoms appear, it is too late to treat the frog.

#### Parasite infestation

Parasites are routinely found in many amphibians and reptiles but they are supposed to be just incidental freeloaders and should not cause any damage to their host. However, in FNQ, we have been researching a problem with severe parasite infestations that have been killing two species of frogs here since 1997 approximately. In all these frogs, the *Spirometra* tapeworm (which only breeds in cats) is being found and usually in severe numbers (more than 100 worms in an adult frog).

Multiple parasites are simultaneously attacking such frogs. A frog with a bad case of *Spirometra* (also known as spargana) might also have bad cases of microfilaria in its blood, *Capillaria* worms in its bladder, other worms in its colon and hydatid worms on its skin. We have not yet had all the parasites identified that are being found in these frogs.

The two species suffering from this problem are the White-lipped tree frog (*Litoria infrafrenata*) and the Common Green tree frog (*Litoria caerulea*). The manner in which the complex seems to work is that a presently unidentified agent is disabling the frog's immune system. Once inoperative, the frog is overtaken by any and all pathogens it encounters. Some frogs are received that have as many as four or five secondary conditions simultaneously. This includes a currently documented list of the parasites mentioned above plus other ailments such as:

excessive bile accumulation (this appears as blue fluid from the site of wounds, the bottoms of toe disks are blue and the tongue can be blue) septicemia gram negative bacterial infections flesh-eating bacteria and fungi head tilt pigment discolouration and disruption (part of the frog's colour looks 'bleached out' or is replaced entirely by patches of dull mauve instead of green) systemic "skin rot" (could be called leprosy judging by its appearance) other separate diseases such as chytrid or the new respiratory disease cancer and other tumours

Frogs with this immuno-deficiency complex can be identified as having a collection of symptoms for different problems at the same time. Any White-lipped or Common Green that has symptoms of *Spirometra* infestation should be suspect. The *Spirometra* symptoms include fluid retention in the calf of one or both legs, a very swollen thigh or the opposite - a thigh that is literally skin and bone, lumps and/or ulcers in the thighs and lower back, 'black and blue' bruising on the inside of the thighs, white worms visible at the site of an ulcer, and

thinning of the skin where small patches on the ventral surface become thin enough to see through but haven't penetrated all the skin layers yet.

With this condition, the frog cannot be cured of the disease, nor can its immune system be restored, although many of the secondary pathogens can be treated. The Spirometra cannot be completely removed from the frog but their impact can be reduced by healing ulcers, eliminating fluid and restoring the frog's weight. The various skin degenerative conditions can be recovered but tumours cannot.

All frogs with the immuno-deficiency problem should be handled the same as any other contagious illness. Disinfection involves bleach followed by very thorough rinsing and towel dry. Frogs affected by any skin problems should be isolated where possible from other frogs and other cold blooded animals.

#### Tumours

With the exception of one frog, all the cancer and other tumour cases we have received here in FNQ have been in the White-lipped tree frog. (The exception was a type of melanoma in the Stony Creek frog (*Litoria leseueri*).) CSIRO also has seen a few cancer cases over the years and most of these were in *Litoria chloris*, the NSW Red-eyed tree frog.

Our tumour cases include squamous cell carcinoma, adenocarcinoma and epidermal papillomas. We have received about 22 tumour cases so far and this is extremely significant considering how rare cancer in amphibians is considered worldwide. Photos of the tumour types are in our website ([www.fdrproject.org.au](http://www.fdrproject.org.au)).

Frogs with any of these tumours are most likely affected by a virus, especially in the herpes group, and should always be handled with gloves and kept away from other animals. Should a frog believed to be cancerous arrive on your doorstep, the Cairns Frog Hospital would like to be notified so that we can arrange for testing and add this information to our research records.

Disinfection is with strong bleach. Pour the bleach straight from the bottle into the tank and use a sponge or tilt the tank so that the bleach saturates all the surfaces for at least five minutes. (Always wear safety goggles and rubber gloves because bleach at this strength will burn your skin and you certainly don't want it to splash into your eyes.) Rinse very well and then use any disinfectant to wash the tank again (this is mostly to break down any bleach residues that water alone won't budge); then rinse very well and towel dry. Wooden perches used in the tanks can be soaked in the bleach as well so long as they are also scrubbed with disinfectant and rinsed very well. Leave perches to dry in the sun for several days before reusing.

#### the Unidentified Respiratory Disease

This turned up in FNQ during the second year of the drought and, as of this writing, we still believe that this disease is a soil fungus. However, the labs have not been able to locate the pathogen in the specimens we've sent for testing.

There are two fungal diseases already known to kill amphibians. The first is chytrid fungus. The second is the soil fungus *Mucor amphibiorum* and this has only been found in cane toads, NSW Red-eyed tree frog (*Litoria chloris*), Common Green tree frog (*Litoria caerulea*) and the White-lipped tree frog (*L. infrafrenata*). *M. amphibiorum* also kills platypus and it is believed that *M. amphibiorum* is ingested. It then goes on to destroy the liver and ultimately causes ulcerative dermatitis (ulcers in the skin). There is no known treatment for *M. amphibiorum*, it is fatal and it is highly contagious once contracted.

In July 2002, frogs showing signs similar to *Mucor amphibiorum* arrived but they had a distinctly different symptom not found in *Mucor* or chytrid fungus - it was respiratory. When frogs and toads with this condition have died, internal examination shows that one or both of their lungs have dramatically increased in size, even to the extent of reaching the vent and occupying 50% of the entire abdominal cavity.

We know that it effects the lungs first, moves into the gastro-intestinal tract and then it becomes subcutaneous, causing excessive irritation and ulcerative dermatitis. It is highly contagious frog-to-frog. It takes up to two months to kill the frog/toad meaning that it has a long period to spread and it appears to affect all amphibians.

While initially, only some suburbs in Cairns, Kuranda, Mareeba and Cooktown were turning in affected frogs and toads, the problem has now spread to such a wide area that we are receiving affected frogs from Torres Strait, Cape York, the coast from Townsville to Cairns, Port Douglas and the Atherton Tablelands. We are also getting calls from other areas outside FNQ but unless we receive the frogs here, we can't verify if they have the same condition.

I believe that any area of Australia that has seen severe drought for more than two years could have this pathogen active locally.

The symptoms for this disease are subtle and easy to confuse with other ulcerative problems such as chytrid, but the respiratory component sets it apart. The symptoms in each species can also vary slightly. For example, the feet on the White-lipped tree frog will go crimson red while the Common Green develops a yellow wash to its feet; other tree frogs develop a brownish wash. (Regional variations in species don't make life any easier either with the Common Green tree frog normally having a yellow wash to its feet if it occurs in northwestern Queensland!)

The disease first shows its presence by causing the frog (or toad) to start shallow, constant panting which is viewed from the top or sides of the abdomen. The eyes also start to take on a drugged look as the pupils reduce their responsiveness to light and shift up slightly in their position in the eyeball (which is normally centered). As the pathogen starts to effect the stomach, the frog responds to the pain by bloating up in the middle abdomen, especially when handled. It could even vocalise at this point. After a few days, the bloating disappears and the skin starts to get loose on the body, usually seen as small folds of skin on the sides. By this point, the frog has lost all interest in food and starts to lose weight.

Signs of skin irritation will start to appear in various ways. Skin secretions increase slightly and can be checked by stroking the back gently with a finger (wearing disposable gloves, of course!) - a small amount of white foam will be present when the finger is lifted. The frog's behaviour will also show a nervous irritation in that, the frog may react ballistically to being touched. It might dart wildly around the room, changing direction frequently as opposed to intended escape by jumping in a specific direction and continuing in that direction. The frog will not want to be handled and will bloat up and squirm constantly.

The other indication of skin problems is that the normally velvety appearance of the skin is replaced by a look of 'wear and tear' in the pigmented layer of skin which allows the white inner dermis to be seen. Little flaws, flecks, gouges and worn patches will be scattered around the dorsal surface (the tops of the legs and the head and back) of the frog but only in the pigmented layer (not all the way through the skin). Increased sloughing on the legs also occurs and since the frog is no longer removing this, it collects in strings and dries, accumulating dirt.

The skin irritation varies between individuals but can become quite intolerable, causing some frogs to repeatedly bash themselves against the walls of their enclosure. Others will start rubbing their bodies with their limbs repeatedly, resulting in a build up of foam on the body and legs!

The irritation becomes visible on the feet after several days of infection. In the White-lipped, the non-green areas of the feet become crimson in colour and white strips are seen in the webbing when the toes are spread apart. These white strips are the inner dermis which is becoming visible because the outer pigmented layer of skin is sloughing off. On some frogs, there can also be small amounts of blood appearing in the tiny pores of the skin on the sides of the feet. In other species, a yellowish or brownish wash will appear on the feet.

In later stages, small ulcers appear anywhere on the body but especially on the eardrums (tympanum), in the feet, and on the sides of the abdomen. The frog is now sliming quite heavily and has lost most of its body weight. It then shifts from a nervous irritation to a very lethargic state. Even the breathing slows down although it is still visible in the abdomen.

Treatment of the frog is by an aquarium product called "Rapid White Spot Remedy" by Aqua Master. The active ingredients are formaldehyde and malachite green, but the former is the one that affects the pathogen. The dosage on the bottle is doubled and the resulting bath replaces plain water in the frog's water bowl. It can also be sprayed on the frog using a plastic spray bottle.

Disinfection of this pathogen is not easy and is labour intensive. Neither bleach nor disinfectant will kill this pathogen but iodine will. All tanks and utensils used for these frogs need to undergo at least two washing stages. We use about a litre of 4% bleach in a sink filled with about 15 litres of water. Items to be washed are soaked for a few minutes and then thoroughly cleaned with disinfectant on the sponge. They are given a rinse and piled up for the next phase.

The tanks/utensils are then soaked in a strong betadine bath. How long this soaking takes place depends on how much betadine is added. If you are only looking after a few frogs, you can use the betadine out of the bottle. Just pour it in the tank and use a sponge to keep distributing it on all the surfaces for at least five minutes. Then rinse well twice and towel dry. If you have a lot of items to treat, then fill a large sink enough to cover the items. Add half a litre to a litre of betadine so that the water is the colour of strong coffee. Soak the items for at least five minutes.

Betadine will 'fix' itself to any pathogen present so when you remove the tanks, you might see brown patches or streaks on them. Just wipe them off with a sponge before rinsing. This is a visible display of a pathogen that the betadine has fixed to. Since you have already removed all traces of dirt, bacteria and viruses when the bleach was used, what remains from the betadine soak will have to be fungal spores!

Betadine can be very expensive if you have several sick frogs to look after. One way to access it is through your local hospital. Several units in a typical hospital will use betadine for various procedures. However, they are only allowed to use an opened bottle for 24 hours and then the remainder is dumped down the sink. We have made arrangements with our local hospital by leaving a drop box in these units. Instead of throwing the unused betadine away, they place the containers in the box and we collect them regularly. We have had to sign a waiver to verify that the betadine will not be used for any human purpose and is only for washing frog tanks. This has been a tremendous cost savings for us and has allowed a wasted resource to be recycled.

## Viruses

These are in the headlines very frequently and virus diversity is expanding worldwide. The travel habits of humans and cargo aid the circulation of these nasty little pathogens and they cause terrible damage that is generally incurable. Viruses are very 'flexible' and can mutate into new strains easily as well as merge with other viruses to create something new. When they mutate or adapt, they can switch to attacking a completely different type of animal (such as the Mad Cow variation that attacks humans and is known as Crutzfeld Jakob Disease or CJD var.)

There are viruses which target frogs and other cold blooded animals and they cause big dents in local populations when they arrive. Huge outbreaks of ranavirus/iridovirus in the UK and the US/Canada have been documented and continue to cause frog decline problems, especially at the later tadpole stages. Many of the cancers appearing in frogs are believed to be caused by viruses. Cancers and leukemia in Tassie Devils and koalas, respectively, are also believed to be viral.

In Australia, viruses are known to be present but their identity and characteristics have not been researched. In FNQ, we know that at least two viruses are responsible for the problems we see but there are likely to be far more than that.

Viruses can be very species-specific, sometimes attacking only one species. At the time of writing, the Cairns Frog Hospital is pursuing the identity of a virus that turned up in one Cairns suburb in the summer of 2002/3 which causes high tadpole mortality and deformities in the Common Green tree frog (*Litoria caerulea*). Cane toad tadpoles in the same area are also suffering from massive die off rates and virus testing has been requested. This past summer (2003/4), deformities appeared in the Common Green tree frog from another suburb clear across Cairns. Symptoms are very similar to the previous summer's incident and mass die-offs of cane toad tadpoles also are occurring.

Symptoms of virus infection are sometimes merely a large number of die-offs in tadpoles or metamorphs. Adult and juvenile frogs and toads can die suddenly but be frozen into position. In other words, a frog which is sitting up normally dies in that position and remains that way, even though it is dead.

With the virus that causes deformities, tadpoles can be washed out in colour, experience frequent die-offs - especially after being stressed such as when being moved or after water changes - or have S bends in their tails. Metamorphs can die suddenly for no obvious reason, have bends in their calves, scoliosis in their spines or go a turquoise two-tone colour.

Viruses should be handled the same way as described in the section above on tumours.

#### Getting Set Up for the Care of Sick and Injured Frogs

If you would like to be involved in the receipt and care of sick and injured frogs, there are various bits of supplies that you should start collecting.

tanks of various sizes to house each frog (pet tanks are good but cheap plastic storage containers with tight fitting, latchable lids from discount stores can be used by drilling holes in them) ramekins and bowls with soft edges clean wooden perches of various lengths and thicknesses from a reputable source where NO spraying has occurred opaque small plastic drinking cups (these are placed on their sides in a corner of the tank for the frog to hide in during the day) a bookshelf (open backed only) to stand the tanks on where they will get good light you will need a local vet to assist with procedures and antibiotics betadine Multicure (aquarium antifungal) White-spot Remedy (aquarium antifungal) takeaway trays and lids ice cream containers and lids liquid B complex vitamins reptile vitamins and calcium powder a source of clean insects such as crickets or woodies (not mealworms or pinky mice!) disposable gloves betadine surgical preparation or scrub bleach disinfectant coffee jar lids (to make water dishes for small frogs) aquarium charcoal mortar and pestle Polyaid emergency bird supplement syringes if preserving dead frogs yourself, specimen containers of various sizes and a supply of 10% neutral buffered formalin (which is a flammable carcinogen so store carefully) or you can rush dead frogs to the vet for the preservation process)

#### Techniques

Unfortunately, the procedures for treating and housing all the diseases and injuries described in this paper cannot be included. Another paper at least twice this length would be needed! The Cairns Frog Hospital is planning to publish the procedures and techniques as soon as possible on our website. This will be done page by page as material is ready (the constant volume of diseased animals in care has delayed this project). Please consult our website periodically for information ([www.fdrproject.org.au](http://www.fdrproject.org.au)) or seek the advice of your veterinarian or nearest 'banana box frog quarantine' setup (run by frog groups in Melbourne and Sydney).

#### Questions and Assistance

We are under-supported and under-staffed but we would like to assist you as best we can with questions you may have about the frogs that are arriving for treatment. We would certainly like to know if any of the diseases we have described in this paper are turning up in other parts of Australia. Any frogs arriving in shipments of bananas from QLD should be suspect.

When you receive a frog, try to get as much background information as you can from its finder. Some questions that might help you form a picture of what's happened to the frog and what sort of environment it was living in are:

When did you first see the frog in this condition and where was it? Has it moved since or just sat in the one spot? Was this a frog that has been in your yard before or did it just turn up? If it is a regular, where does it usually hang out? Have the numbers of frogs you find on your property changed at all in the past few years? Have you seen any sick or skinny toads lately or do the toads look fine? Do you or your neighbours have any cats or dogs? Has there been any herbicide or pesticide spraying on yours or a neighbour's property in the past several days? Have you had any pest control treatments done inside the house or on the property in the past few months? Have you seen any sick or dead frogs on your property before now? (ask about toads also if the finder is in an area where cane toads occur) How many other frogs do you have on the property at the moment? Do you have a source of water for the frogs on your property (e.g., stream, pond, dam, birdbath)? Is your property well vegetated? Have frogs used your pond for breeding and, if yes, did the tadpoles survive and metamorph or did they seem to dwindle without completing their development?

When receiving a frog for care, always get the exact address or location description where the frog was found as well as the finder's name and phone number. Note the date and any details they provide as well as your own description of the frog's appearance and behaviour. This information can be kept on the frog's enclosure until it has left care. Then it can be stored in a file or a computer database for later retrieval.

If you have access to a digital camera, this can be very useful in showing us what the frog looks like. Take top and side views of the whole frog and then clear closeups of specific details that are present such as marks, wounds and ulcers. These photos can be emailed to us.

Technically speaking, we can receive frogs from anywhere in Australia that has an airport and flights to Cairns. (Do not put a frog onto a flight without notifying us by telephone in advance!) However, there may be different regulations in each state which might require a permit to move the frog from your state to Queensland. If you are going to be receiving frogs for care, please check with your local authorities in advance and ask for some blank forms so that when an animal arrives that needs to be shipped, you have the required paperwork ready.

To contact us, you can ring (07) 4053-4367 in the afternoons or evenings. Emails can be directed to: [deborah@fdrproject.org](mailto:deborah@fdrproject.org) but if you are asking about an urgent case such as burns or an extremely debilitated frog, please use the telephone. Our postal address is: P. O. Box 2731, Cairns, QLD 4870 and our comprehensive website is [www.fdrproject.org.au](http://www.fdrproject.org.au)

There is another website with information about chytrid fungus which is maintained by Assoc. Prof. Rick Speare of James Cook University in Townsville. The url is very long and changes when system wide upgrades are done. The best way to access that site is to request an exact match in your search engine as follows: "chytrid fungus" PHTM "Richard Speare" and it should appear at the top of your list. We also have a link to the site and others in our links page.