

# INFECTIOUS DISEASES ASSOCIATED WITH CAVES - AN AUSTRALIAN PERSPECTIVE

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A recent article published in the journal *Wilderness & Environmental Medicine* (2011, Volume 22, pages 115-121) may be of interest to cavers, cave managers, scientists and others who visit caves, especially outside Australia. The article, titled *Infectious Diseases Associated with Caves*, is by Dr Ricardo Pereira Igreja, from the Department of Preventive Medicine, Faculty of Medicine, Federal University of Rio de Janeiro, Brazil. It seems to be aimed primarily at clinicians, but it summarises the infectious risks for cave users, and some of the precautions that can be taken against them, in a readable fashion. The paper should be read in conjunction with this discussion. It is somewhat simplistic in its discussion of who visits caves and why they do. It doesn't cover all the diseases that might affect Australian cave users. Read it in full at [http://www.wemjournal.org/article/S1080-6032\(11\)00069-X/fulltext](http://www.wemjournal.org/article/S1080-6032(11)00069-X/fulltext).

The abstract reads:

In recent times, caving has become increasingly popular, with almost 2 million people visiting national park caves each year in the United States. Although the 2 million tourist visits are extremely low risk, smaller numbers of sport cavers are at risk for some high risk conditions, and expedition cavers are at risk for some obscure infections. Infectious diseases like histoplasmosis, rabies, leptospirosis, and tick-borne relapsing fever may be transmitted by the underground fauna. To reduce the risk of illness or injury while caving, knowledge of potential risks before engaging in this activity is important. Caving preparation needs to be carefully planned and executed, including vaccinations, prophylactic medications, and advice regarding safe conduct and behaviors.

Below are some comments on the different sections of the paper, with particular reference to the situation in Australia. They are not complete in themselves but are intended to be read in conjunction with the paper. Please note that none of the three authors of these comments is either a medical doctor or an expert on any of the diseases discussed, so if you are concerned about a possible exposure you should consult your medical adviser and/or the Department of Health.

**There are at least three potential disease vectors associated with caves - bats, arthropods and birds. We will discuss each of these in turn below with the diseases in the same order as in Dr Igreja's paper**

## BATS

In discussing the role of bats, it is important to note that the Order of bats, or Chiroptera, is divided into two main groups: the Megachiroptera ("megabats") and the Microchiroptera ("microbats"). The megabats include the flying foxes; they are all fruit, nectar or pollen eaters and they do not occur in the Americas or Europe. The microbats are found on every continent except Antarctica. Most are insectivorous and some are cave-dwellers; in Australia all cave-dwelling bats are microbats. However, some microbats in the Americas eat fruit or nectar and may be referred to as "fruit bats" - and some African and Asian megabats live in caves. The largest microbats are bigger than the smallest megabats, as exemplified in Australia by the big "micro" ghost bat and the little "mega" blossom bats.

The distinction between the two groups is important because, in the last fifteen years, several "emerging" diseases affecting humans have been traced to a possible origin in one or more species of bat, and in almost every case these have been megabats.

So, although Dr Igreja is right in saying bats are linked to the transmission of the three diseases he lists, this is an oversimplification. Any bat may give you rabies, no bat will give you histoplasmosis, and only a megabat (as far as we know to date) will give you Marburg haemorrhagic fever.

## Histoplasmosis

Histoplasmosis does occur in Australia. There are reports of cases in cavers from Wee Jasper, Bungonia, Timor (NSW) and Chillagoe as well as in geologists using mines, and one death apparently associated with the demolition of a battery hen building in South Australia. The disease is acquired **by exposure to Histoplasma spores in dust generated by disturbance of dry guano**, not directly from bats nor from other infected animals or people. Bats can become infected, and thus could theoretically transfer the causative fungus from one cave to another by faecal contamination.

Smith (1994) and Spate (1994: available on the ACKMA CD) provide discussions of histoplasmosis in Australia. Whitten's very personal paper (1992) makes for interesting reading as it indicates how the medical profession can overlook the possibility of diseases such as histoplasmosis.

It's a good idea to wear a proper mask (not just one of those *el cheapos* you get in hardware stores) wherever there's a likelihood of heavy exposure to dried guano,

whether bird or bat. This mask should be of the particle filter type and fit well. NIOSH (2005: National Institute Occupational Safety and Health: *Histoplasmosis Protecting Workers at Risk* See: <http://www.cdc.gov/niosh/docs/2005-109/>) provides detailed advice. Should you suffer pulmonary or upper respiratory problems within about two weeks of caving it would be prudent to advise the medical system of your possible exposure to histoplasmosis. Anti-fungal treatment may be warranted and this is quite different from treatment for tuberculosis. **In some individuals progression to disseminated histoplasmosis can be a life threatening disease.**

### Rabies

“Classic” rabies doesn't occur in Australia, but the closely related Australian Bat Lyssavirus, which is present here in megabats and some species of microbats, produces an identical disease and has killed two people. **In one instance the source of the transmission to humans was a bite from a fruit bat and in the other from handling a microbat, the non-cave-dwelling yellow-bellied sheath-tail bat (*Saccolaimus flaviventris*). The Australian Bat Lyssavirus has been isolated from four species of megabat (flying foxes) and from the yellow-bellied sheath-tail bat. Antibodies to the Australian Bat Lyssavirus have been found in seven genera representing five of six families of microbats in Australia. Some of these are cave dwelling bat species (Anon, 2009).**

Experts are divided over whether the virus has always been in Australia or is a recent introduction. If the latter is the case, it could still be expanding into new species. Certainly, overseas bats of the same genera as our common cave-dwelling species have been shown to carry Lyssaviruses. **All** bats should be regarded as potential carriers. Anyone likely to be handling them (e.g. for research or rescue purposes) should receive prophylactic vaccination. Ordinary cavers should stay out of chambers with bats in them, thus avoiding both disturbance of bats and risk of infection.

### Marburg – and Ebola – Haemorrhagic Fevers

These only need to be considered if you are going overseas – mainly to Africa. In Africa, human infections with both these viruses have been linked to infections in various species of megabat. In the case of Marburg virus, the bat involved is a member of the genus *Rousettus*. This is the only genus of megabat that lives in caves (and echo-locates.). There are **no** cave-dwelling megabats in Australia, but there are some species of *Rousettus* in Asia.

Recently a type of Ebola virus has been discovered in the Philippines. However, it is different in that, so far, it does not seem to cause disease in people and it has not been

detected in bats.

### Hendra Virus

This virus has no connection to caves or microbats. We include it because it has been in the news lately, with deaths of horses in Queensland and northern NSW, and statements by some prominent people along the lines of “we must kill all the bats”!

Hendra virus is a new type of virus which first appeared in Brisbane in 1994. It is now known to be carried by flying foxes – i.e. megabats. It has never been found in microbats. Horses are apparently infected by the flying foxes, and in some cases have then passed the disease on to people (and to one dog). There have been no cases of people being infected directly from the bats. Because the virus is frequently fatal to horses and people it is causing grave concern, but it should not be an excuse for killing either mega- or micro- bats. It is hoped that a vaccine for horses will be available by next year, and this should prevent further occurrences.

A similar virus, Nipah virus, is found in megabats, particularly of the genus *Pteropus*, in Asia and parts of East Africa. In the initial outbreak, in Malaysia, pigs were infected first and passed the virus on to people; however, the virus can sometimes be passed directly from bats to humans. There are so far no records of it in cave-dwelling megabats.



*Grey-headed flying foxes have been causing major concerns because of Hendra virus*

### Severe Acute Respiratory Syndrome (SARS)

SARS was a viral disease that emerged in China in late 2002. It spread rapidly, thanks to air travel, to several countries in Asia, Europe and North America, and killed several hundred people before it was eradicated. It is thought that the ultimate source of the virus was Chinese horseshoe bats (*Rhinolophus sinicus*), since a similar (though not identical) virus has been found in

them. It is likely that another type of animal was infected by the bats and then passed the virus to humans. Closely related viruses have been found in other species of *Rhinolophus* in Europe. Horseshoe bats are microbats and cave-dwellers. We have three species in Australia, with *Rhinolophus megaphyllus* being found all along the mainland east coastal strip, and there is no reason to think that they do not carry similar viruses. It should not be cause for alarm but another reason to treat bats with respect and to observe good hygiene when in contact with any sorts of animals or their excreta.

### Leptospirosis

This disease does occur in Australia and the bacteria are carried by many types of animal. It is present in native rodents, especially in the tropics, in marsupials including wombats, bandicoots and possums (possums in New Zealand too), and in megabats, but doesn't seem to have been detected in microbats – probably for want of looking. It is also found in many introduced animals including rats, house mice, deer, cattle and pigs. With the possible exception of caves in the tropical north, the greatest risk to cavers might be in a wet cave contaminated by effluent from dairies or piggeries, or if they explore drains or sewers – but then there would be other risks too, such as salmonellosis.

### ARTHROPODA

Tick-borne relapsing fever hasn't been recorded in Australia but there are a few rickettsial diseases carried by ticks or mites, not to mention the paralysis toxin produced by the scrub tick. And we have plenty of mosquito-borne diseases (Dengue, Ross River, Barmah Forest Fevers, Murray Valley Encephalitis,). We imagine all these would be more of a risk on the surface than in a cave, except in the entrance area. The idea of wearing insecticide-impregnated clothing inside a cave, as suggested by Dr Igreja, concerns us. This could be fatal to any cave-dwelling arthropods, which are likely to be harmless and maybe even rare and vulnerable, rather than disease-carrying.

### BIRDS

Cryptococcosis and psittacosis both occur in Australia, but so far no cases are known to have been associated with caves. People who are immuno-compromised or suffer from pulmonary disease should seek expert medical advice before caving, particularly if there is a likelihood of exposure to bird or bat guano.

### IT GOES BOTH WAYS

Animals that live in caves may occasionally pass diseases on to people, but it works the other way too:

People may very easily carry disease-causing organisms from one cave to another, with devastating results to the inhabitants. So, please, be careless if you like about your own disease risk – Earth has no shortage of humans – but be very careful about cleaning and disinfecting your clothes, boots and gear between one cave area and another, and be absolutely over-the-top obsessive about it when moving between continents.

**Perhaps it is worth mentioning with regard to all the newer human infectious diseases derived from animals (zoonotic diseases) that these appear to be due to human interference with the animals themselves or their habitats.**

### SUMMARY

In summary, the paper discusses a number of diseases which pose risks to cavers, cave researchers and others. Of those listed histoplasmosis is certainly a risk for people entering bat caves in Australia. The paper will be of interest for cavers and speleologists visiting other parts of the world.

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