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This article is from the [July–October 1993](#) *AFRMA Rat & Mouse Tales* news-magazine.

The Problem With Pine: A Discussion of Softwood Beddings

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Most rat and mouse people know to avoid cedar shavings. The primary reasons for doing so have been the increased incidence of respiratory problems, including pneumonia, and suspected links to various forms of cancer. However, many people may not realize that not only are there additional dangers associated with cedar shavings, but that pine shavings contain similar toxins and consequently, can be linked to similar problems.

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Stories of long-lived rats and mice are, perhaps, apocryphal. However, several years ago, when discussing the cedar/pine issue with a veterinarian, I heard a particularly interesting tale. This man had lived with a number of rats over the years, and while most of them had used pine shavings as bedding, the rat he owned while he was in school (and very poor) lived primarily on shredded newsprint. Although every other rat he owned lived the standard 2–3 years, this particular rat lived (according to him) over 6 years. He remembered this rat as we talked about cedar and pine and wondered if perhaps there was a connection. While such a story does not constitute proof, it is food for thought.

Rabbits And Pine

In 1989, the House Rabbit Society, which has fostered thousands of rabbits until homes can be found for them, made an accidental discovery (Harriman 8-9). When a young, healthy rabbit died following a routine spay, HRS ran

blood work and discovered that the rabbit's liver enzymes were elevated far above normal. Because there was no obvious reason for this elevation, blood chemistries were run on rabbits in foster homes around California, many of whom turned up with the same enzymes elevated. The only difference noted in the rabbits' environments was that those with elevated liver enzymes were all using pine shavings in their litter boxes or cage trays; the ones with normal livers were using cat litter.

In order to determine if the pine shavings were indeed at fault, the shavings were replaced with cat litter and the rabbits' blood levels were rechecked a month later. Without exception, all the previously abnormal liver enzymes had returned to normal. At the same time, an informal survey was conducted of HRS members whose rabbits had died of liver disease (diagnosed upon autopsy or through blood work). Invariably, either cedar or pine shavings had been used with all of these rabbits.

As far as possible connections with rats and mice go, it is important to realize that without blood work, a liver biopsy, or an autopsy, it is difficult to diagnose liver disease. Consequently, while liver disease may not be documented as a common cause of rat and mouse deaths, many cases of rats and mice dying of "old age" may in fact have been related to liver failure. When an older rat or mouse stops eating, becomes lethargic, and just "fades away," many causes are possible, but liver disease is certainly among them. It is true that rats and rabbits are different species, but in general, what is hepatotoxic (causative of liver damage) in one mammalian species is hepatotoxic in another. This is why rats and rabbits are used so often in pharmacological studies involving adverse drug reactions in human beings.

Phenol Alert

Although this information is hardly common knowledge, the laboratory animal community has recognized since at least 1967 that cedar and pine shavings, both of which contain phenols, are potentially toxic to small animals (Vesell, Cunliffe-Beamer). Phenols are caustic, poisonous, acidic compounds present in softwoods, which are routinely diluted for use in disinfectants (for instance, Pine-Sol and Lysol both use phenols and can cause liver and kidney damage in rodents, rabbits, cats, dogs, and humans). They are what make disinfectants cover smells and cedar and pine shavings cover the smell of animal urine.

Since phenols are caustic, their direct connection to respiratory problems and pneumonia in rats, mice, and

guinea pigs is clear. The constant irritation to the nasal passages, throat, and lungs gives harmful bacteria an easy opening. Phenols also affect organs such as the liver and kidneys because these organs are responsible for filtering blood and urine and eliminating toxins from them. While the kidneys and liver can handle a small amount of toxins, when they are presented with a large amount over time, they are unable to filter it all out and begin to fail. In addition, a rat or mouse with a damaged liver will have a depressed immune system, which can lead to more common "old age" symptoms such as respiratory and pulmonary infections. Interestingly, one of the main causes of death in older hamsters is amyloidosis of the kidneys. The cause is often considered idiopathic (not known), but if cedar and pine shavings can damage the kidneys, the possibility for a connection between bedding and disease once again surfaces.

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Researchers Study Wood Beddings

One of the early medical studies of softwood beddings and hepatotoxicity found a connection between the use of red cedar, white pine, and ponderosa pine and changes in both barbiturate sleep time and the activity of liver enzymes (Vesell 1057). The researchers proved that the length of barbiturate sleep time (the amount of time a mouse or rat stays "out" when under a controlled dose of anesthesia) was inversely proportional to the level of enzyme activity in the liver (i.e., that sleep time decreased as enzyme activity increased). This inverse ratio occurs because the hepatic enzymes control the metabolism of the barbiturates. In an attempt to deal with the toxin (phenols, in this case), the liver produces more enzymes and hence, wakes the mouse up sooner. This study determined that softwood beddings alter the liver's activity in response to drugs significantly enough to suggest that such beddings not be used for animals in pharmacological experiments for fear of skewing the results.

Another study goes even further. It concludes that rats and mice kept on four bedding types were affected most by red cedar, but that white pine was the next most hepatotoxic bedding. In fact, "sleep times of C57BL/6J male mice on each bedding were significantly different in the following order: mixed hardwood > white spruce > white pine > red cedar. In both strains, liver:body ratios of mice on red cedar

bedding were significantly increased compared to mice on white pine, white spruce, or mixed hardwood beddings" (Cunliffe-Beamer 672). Mice kept on mixed hardwood bedding slept an average of 135 minutes, while those on cedar slept an average of 56 minutes. Mice housed on white pine slept an average of 85 minutes—between the other two sleep times, but closer to the sleep time of cedar than that of hardwood (see Table 1). Enzyme activity was significantly increased in cedar and pine mice and their livers were heavier (i.e., more greatly damaged) than those mice kept on hardwood. It is important to realize that the level of hepatotoxicity noted here was induced by only 24 hours to 5 days of exposure to the beddings in question.

Bedding	Sleep time (minutes) (combined mean of autoclaved and unautoclaved bedding - C57BL/6J mouse strain)
Hardwood	135 +/- 6
Spruce	123 +/- 5
Pine	85 +/- 4
Cedar	56 +/- 3

TABLE 1. Adapted from Cunliffe-Beamer 673.

Other studies abound, including one concerning cocaine hepatotoxicity in different species of mammals. In addition to studies with non-pretreated animals, the researchers intentionally induced liver damage in some of the mice solely by housing them on pine shavings! (Connors) Another study determined that exposure to both hardwood and softwood dust can cause squamous cell cancers of the upper respiratory tract (Vaughan).


Clearly, there is sufficient evidence to suggest that pine shavings can cause similar problems to cedar shavings, and that therefore, they should be avoided. Because none of these studies included a non-wood bedding in their samples, it is difficult to know if hardwood bedding is truly safe, but hardwood beddings, or the softwood spruce, which in the 1981 study appears to be less toxic than cedar and pine, are certainly safer choices.

Wood Alternatives

There are many alternatives to wood shavings, most of which are just as absorbent and make excellent bedding.

Perhaps the nicest of all is [CareFRESH™](#), a paper pulp product which is made from non-toxic, untreated cellulose fiber. The pieces are small and soft (not pelleted), and in fact feel very much like shavings. [CareFRESH™](#) is truly dust-free, controls odor beautifully, and makes a nice nest. Another option is plain, unprinted newsprint. Most newspapers will either give away or sell for a nominal cost the end of their newsprint rolls, which can then be shredded into comfortable, absorbent bedding and used in sheets on the bottom of the cage.

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The dangers posed by pine shavings are just as serious as those posed by cedar. While cedar shavings may smell stronger, *all* softwoods contain deadly phenols, and pine has been implicated in organ damage and respiratory disease just as cedar has. While in the past this information was not widely disseminated, there is now sufficient evidence that softwood beddings are just not safe for small animals. Please consider discontinuing their use—and let's all try to educate pet stores and veterinarians as well. 

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Updated October 23, 2012

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