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## Rabies in Vaccinated Raccoons from Ontario, Canada

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**ABSTRACT:** From 1999 to 2006, 132 cases of raccoon rabies, caused by the raccoon variant of rabies virus, were confirmed in eastern Ontario, Canada. Trap-vaccinate-release (TVR) and point infection control (PIC) programs were implemented to control the disease; 43,014 raccoons (*Procyon lotor*) were vaccinated against rabies by injection (Imrab<sup>®</sup>3) during that period. Two vaccinated raccoons were diagnosed with rabies at 6 mo and at 2 wk postvaccination. One may have been due to a vaccination failure. The other was likely due to the animal being in the late stages of incubation for rabies at the time of vaccination. This information will be useful to wildlife rehabilitators and agencies that hold raccoons in captivity in that a vaccinated raccoon is not necessarily immune to rabies.

**Key words:** *Procyon lotor*, rabid raccoon, rabies, raccoon, vaccination.

In response to the threat of the raccoon variant of rabies virus (hereafter referred to as raccoon rabies) moving into eastern Ontario, Canada, from the United States (Winkler and Jenkins, 1991; Guerra, 2003; Slate et al., 2005), the Ontario Ministry of Natural Resources (OMNR) initiated a proactive trap-vaccinate-release (TVR) program along the St. Lawrence River in 1995 (Rosatte, 2000). That TVR program as well as active point infection control (PIC) programs continued after raccoon rabies was confirmed in eastern Ontario during July 1999 (132 cases were reported during 1999–2006) (Wandeler and Salsberg, 1999; Rosatte et al., 2001). Between 1999 and 2005, 43,014 raccoons (*Procyon lotor*) were live-trapped (#106, #108 Tomahawk, Tomahawk Live-Trap Co., Tomahawk, Wisconsin, USA), ear-tagged (numbered size 3 and 1, National Band and Tag Co., Newport, Kentucky, USA), vaccinated with an intramuscular injection in the hind leg with Imrab<sup>®</sup>3 inactivated rabies vaccine

(Merial Inc., Athens, Georgia, USA), and released at the point of capture. Active surveillance for rabies in eastern Ontario by OMNR staff was very intense with 8,560 raccoons being submitted for rabies diagnosis during PIC programs between 1999 and 2005. Two of the vaccinated raccoons mentioned in these TVR operations (as well as two vaccinated raccoons reported previously in Rosatte et al., 2005) were later diagnosed rabid (raccoon rabies). Specimens were screened for rabies by using the fluorescent antibody technique at the Canadian Food Inspection Agency, Ottawa Laboratory Fallowfield, Nepean, Ontario, Canada (Webster and Casey, 1988). The variant of rabies virus was determined using monoclonal antibodies. The first raccoon, an adult male from Wolfe Island, Ontario, Canada (44°9'N, 76°24'W), vaccinated on 7 July 1999, was collected for rabies testing on 30 December 1999 and confirmed rabid on 31 December 1999. This raccoon attacked a cat and was shot and killed by a resident. The second raccoon was a juvenile male that was live-trapped, ear-tagged, and vaccinated (Imrab<sup>®</sup>3) near Delta, Ontario, Canada (44°45'N, 75°50'W) on 29 August 2002. This raccoon was killed by a dog on 12 September 2002, and it was confirmed rabid on 13 September 2002.

The juvenile male raccoon was collected for diagnosis 14 days postvaccination. Although it has been demonstrated that raccoons will develop antibodies against the rabies virus as early as 5 days postvaccination with Imrab<sup>®</sup> (Rosatte et al., 1990), it is thought that vaccination will not protect an animal that is incubating rabies. Incubation periods for raccoon rabies ranged from 10 days to 107 days

for captive animals (Winkler and Jenkins, 1991). Tinline et al. (2002) estimated the modal incubation period for raccoon rabies in Ontario in the wild to be about 5–6 wk with a maximum of 19 wk. It is likely that this raccoon was incubating rabies at the time of vaccination. A similar scenario was found in eastern Ontario, Canada, when Rosatte et al. (2005) reported rabies in two raccoons 1 day and 17 days postvaccination.

The adult male raccoon was confirmed with rabies 6 mo postvaccination, indicating that the animal was not protected against rabies and that vaccination had failed. Previous studies indicated that Imrab<sup>®</sup>, when administered intramuscularly, is 98% effective at stimulating an immune response in raccoons (Rosatte et al., 1990). That is, a limited number of vaccination failures can be expected. Considering the number of raccoons that were vaccinated against rabies with Imrab<sup>®</sup>3 during 1999–2005, one apparent vaccination failure in >43,000 vaccinations is not unusual; however, one cannot rule out improper administration of the vaccine, improper storage, or a prolonged incubation period as the cause of the failure. It also is acknowledged that some of the vaccinated animals may have contracted rabies and died without being found. However, the likelihood of this representing a common event is remote due to the intense level of surveillance in the vaccination zone. This information will be useful to wildlife rehabilitators and other facilities (e.g., zoos and game farms) that hold animals such as raccoons in captivity. Although the probability of vaccine failure is low, one should not assume that a raccoon is immune to rabies because it has been vaccinated.

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