Black bears found to have surprising wound healing capabilities during hibernation

March 21 2012, by Bob Yirka

American black bear - Ursus americanus. Image: Greg Hume/Wikipedia.

(PhysOrg.com) -- For most mammals, small cuts and scrapes to the skin during times of low body temperature or slowed metabolism usually means a reduced ability to heal and a higher incidence of infection. This is why a discovery by a team of scientists studying bears in Minnesota is so surprising. They have found, as they describe in their paper published in the journal *Integrative Zoology* that black bears who incur small cuts to the skin have an adaption that allows for wound healing during hibernation that results in little to no infection and hardly any scarring.

The researchers, from both Minnesota and Wyoming University's along with the state's Department of Natural Resources, who together have

been monitoring black bears for twenty five years, took note of anecdotal evidence over the years suggesting that sleeping bears had amazing recuperative abilities during hibernation, despite existing in a state that would cause infections in other mammals to run rampant. While in hibernation, a black bear's heart rate slows from an average of 55 beats per minute to just five and their metabolism slows to just 25% of its normal rate . Also their body temperature drops about 13°F and they don't eat or drink anything or defecate or urinate. This all goes on for five to seven months over the winter. Stranger still, when they finally wake in the spring, they haven't lost any bone or muscle mass.

To prove that wounds really do heal well in the bears while they hibernate, the team anesthetized several of them and induced small cutaneous wounds during the time shortly before they were to go into hibernation. After that, they let the bears sleep for about three months, then ventured into their dens to see how the wounds were progressing. In all cases they found no incidence of infection and complete healing of the wounds, all with very little scarring. They also found a regrowth of fur in many of the sites.

Now that the researchers have shown that wounds do heal with black bears during hibernation, the search will begin to figure out how it comes about. The hope is that if the process can be explained that it might be applied to people, such as diabetics who quite often are subject to small wounds that refuse to heal and leave them at constant risk of infection.

More information: Wound healing during hibernation by black bears (Ursus americanus) in the wild: elicitation of reduced scar formation, *Integrative Zoology*, Volume 7, Issue 1, pages 48–60, March 2012
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Abstract

Even mildly hypothermic body or limb temperatures can retard healing processes in mammals. Despite this, we observed that hibernating American black bears (Ursus americanus Pallas, 1780) elicit profound abilities in mounting inflammatory responses to infection and/or foreign bodies. In addition, they resolve injuries during hibernation while maintaining mildly hypothermic states (30–35 °C) and without eating, drinking, urinating or defecating. We describe experimental studies on free-ranging bears that document their abilities to completely resolve cutaneous cuts and punctures incurred during or prior to hibernation. We induced small, full-thickness cutaneous wounds (biopsies or incisions) during early denning, and re-biopsied sites 2–3 months later (near the end of denning). Routine histological methods were used to characterize these skin samples. All biopsied sites with respect to secondary intention (open circular biopsies) and primary intention (sutured sites) healed, with evidence of initial eschar (scab) formation, completeness of healed epidermis and dermal layers, dyskeratosis (inclusion cysts), and abilities to produce hair follicles. These healing abilities of hibernating black bears are a clear survival advantage to animals injured before or during denning. Bears are known to have elevated levels of hibernation induction trigger (delta-opioid receptor agonist) and ursodeoxycholic acid (major bile acid within plasma, mostly conjugated with taurine) during hibernation, which may relate to these wound-healing abilities. Further research as to the underlying mechanisms of wound healing during hibernation could have applications in human medicine. Unique approaches may be found to improve healing for malnourished, hypothermic, diabetic and elderly patients or to reduce scarring associated with burns and traumatic injuries.

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