

## Elephant Deaths are a Matter of Physics

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The death of two elephants at the Lincoln Park Zoo should come as no surprise. While it is obvious that cold weather is bad for species that have evolved in tropical climates, understanding the death-inducing effect of confinement to concrete cells requires a rudimentary knowledge of physics (I have taught astronomy at the University of Illinois at Chicago).

When animals take a step in their natural, sod environment, the concussion felt when the foot lands is muffled. When walking on concrete or pavement, no such effect occurs. This is why shoes are cushioned, and special running shoes are manufactured for those foolhardy enough to run on streets.

The damaging effects exceed the obvious orthopedic ones. The concussive effect is proportional to the weight of the body. For massive animals such as the elephant, the effect is horrendous and is easily calculated. It can amount to three times the weight of the body. For a 5-ton elephant, that is a force of 15 tons -- as if the weight of seven automobiles is slammed into the body. Mammal bodies are composed largely of water, an incompressible fluid. When that force hits the elephant's body, the concussion is transmitted through the legs, and upward through all the organs of the body.

The cells of those organs are ruptured. This occurs notably among the delicate cells of the alveoli of the lungs. That is the source of the well-documented prevalence of deaths due to tuberculosis, a disease of the lungs, among captive elephants and other large mammals. As the many organs in the body necessary for digestion are also damaged, emaciation is also a common occurrence. Damage to brain tissues results in dementia. Ruptured capillaries results in internal bleeding and anemia. All result from the continual concussive effects of 3G (three times the force of gravity) deceleration. It is as if the elephant experiences hundreds of minor automobile accidents each day.

Confinement of large mammals such as the rhinoceros, elephant, giraffe and buffalo to concrete cells is a death sentence. After the first elephant death, the Chicago City Council ignored the plea of actress Gillian Anderson to pass a resolution asking for the return of the two surviving elephants to more suitable locations.

As for the administrators of Lincoln Park Zoo, they may not have understood the physics, but after the death of one elephant, they should have put ticket sales behind animal welfare in their priorities. Sadly for the elephants, they chose not to.

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