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Special Species

Beached Dolphins and Whales: Is Alzheimer's to Blame?

Why do large groups of dolphins - and even whales - sometimes get stranded in shallow water? Researchers from the University of Glasgow have a hunch: The leader of these groups may be suffering from brain changes not unlike those that occur in humans with Alzheimer's.

Analysis by Dr. Karen Shaw Becker

STORY AT-A-GLANCE

- Researchers from the University of Glasgow and colleagues tested 22 deceased toothed whales, detecting brain changes linked to Alzheimer's disease in humans in three of the animals — a white-beaked dolphin, a bottlenose dolphin and a long-finned pilot whale
- While all of the aged animals had amyloid-beta plaques in their brains, the three animals also had additional dementia-related pathologies in their brains
- Since these multiple hallmarks of Alzheimer's disease occurred simultaneously, it's likely the animals developed the Alzheimer's-like condition spontaneously
- The finding could explain why large groups of dolphins sometimes get stranded in shallow water, supporting the "sick-leader theory"
- It's possible a leader of the group, suffering from dementia-like symptoms, could get confused and the others follow

Alzheimer's disease was thought to be a condition unique to humans, but new research suggests toothed whales, or odontocetes, may also be susceptible.[1] The finding could explain why large groups of dolphins sometimes get stranded in shallow water, supporting the "sick-leader theory." It's possible a leader of the group, suffering from dementia-like symptoms, could get confused and the others follow.

Because cetacean species often live in highly cooperative groups, it's also possible that neurodegenerative disease has the chance to progress to later stages. While most wild animals with cognitive problems are unlikely to survive for long if they're solitary, a study published in the European Journal of Neuroscience notes:[2]

> "*Epimeletic (care-giving) behavior towards diseased or dying individuals has been recorded frequently in free-ranging odontocetes of several species. If individuals of these species develop clinical disease or impaired cognition, group members can aid their survival thereby allowing the severity of the pathology to progress.*"

Alzheimer's Disease Likely in Stranded Dolphins

Researchers from the University of Glasgow and colleagues tested 22 deceased toothed whales, detecting brain changes linked to Alzheimer's disease in humans in three of the animals — a white-beaked dolphin, a bottlenose dolphin and a long-finned pilot whale.[3]

"Abnormal levels of the beta-amyloid protein had accumulated into plaques that disrupt neurons in the brain, another protein called tau had gathered into tangles inside the neurons, and there was a build-up of glial cells, which cause inflammation of the brain," The Guardian reported.[4]

While all of the aged animals had amyloid-beta plaques in their brains,[5] the three animals mentioned also had additional dementia-related pathologies in their brains. Since these multiple hallmarks of Alzheimer's disease occurred simultaneously, it's likely the animals developed the Alzheimer's-like condition spontaneously, the study found.

However, because the animals weren't also studied while living to monitor behaviors and more, the researchers can't confirm they were suffering from Alzheimer's. Lead researcher Dr. Mark Dagleish of the University of Glasgow told The Guardian:[6]

> "*These are significant findings that show, for the first time, that the brain pathology in stranded odontocetes is similar to the brains of humans affected by clinical Alzheimer's disease.*
>
> *While it is tempting at this stage to speculate that the presence of these brain lesions in odontocetes indicates that they may also suffer with the cognitive deficits associated with human Alzheimer's disease, more research must be done to better understand what is happening to these animals.*"

Does Deep Diving Contribute to Dementia in Whales?

Whales dive to deep depths of the ocean, exposing them to low oxygen environments that could lead to hypoxia, or low levels of oxygen. Beaked whales, for instance, dive more than 1,000 meters below the surface and hunt squid and other marine life for about an hour at a time.[7]

In tests on nine toothed whales, six (67%) were positive for amyloid-beta and anti-neurofibrillary tangle (NFT) antibodies, suggestive of Alzheimer's-like disease. "Our findings could be linked to hypoxic phenomena, as they were more extensive in beaked whales. Despite their adaptations, cetaceans could be vulnerable to sustained and repetitive brain hypoxia," researchers wrote in Biology Open.[8]

A 40-year-old dolphin living in captivity also had brain changes indicative of Alzheimer's disease, including amyloid beta and tau tangles.

"Our findings are indicative of early AD [Alzheimer's disease] or mild cognitive impairment pathology. So, they strongly reinforce the statement that dolphins could be a natural animal model of AD due to their lifespan, brain lesions and Aβ [amyloid beta] homology with the human peptide," according to the Veterinary Record Case Reports study.[9]

Is Dementia Responsible for Stranded Dolphins?

While the reason why dolphins and whales get stranded — either individually or in mass events — is unknown, it's possible cognitive changes similar to Alzheimer's disease could be involved.

"We were fascinated to see brain changes in aged dolphins similar to those in human ageing and Alzheimer's disease. Whether these pathological changes contribute to these animals stranding is an interesting and important question for future work," said study author Tara Spires-Jones with the University of Edinburgh.[10]

The work does seem to support the sick leader hypothesis, which suggests an unwell leader of a pod strands itself, leading healthy members of the group to do so as well. According to the study:[11]

> *"In humans, the first symptoms of AD-associated cognitive decline include confusion of time and place and a poor sense of direction. If the leader of a pod of G. melas suffered from a similar neurodegenerative-related cognitive decline, this could lead to disorientation resulting in leading the pod into shallow water and subsequent stranding."*

While sick individuals are also known to beach themselves, beaked whale strandings have also been linked to naval sonar systems. When exposed to sonar, the whales become panicked and swim quickly away from the sound, causing a form of decompression sickness in the otherwise adept divers — and subsequent strandings.[12,13]

But, often, there's no known cause in the case of mass strandings, such as the 100 pilot whales that died on New Zealand's Chatham Islands in 2020.[14] While Alzheimer's disease could certainly be involved, other potential causes include extreme weather, predators chasing the pod, noise pollution and beaches with long, gently sloping inclines, which may be more difficult for the animals to detect.

Sources and References

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