Major Points of the Paper

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A new horned dinosaur, *Spinops sternbergorum*, was named for fossils discovered in Alberta, Canada.

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Spinops helps scientists to better understand the evolution of the frill in horned dinosaurs.

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The fossils of *Spinops* were collected in 1916, but were only recently completely prepared for scientific study.

The New Name

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Pronunciation: SPIN-ops stern-berg-OR-uhm

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The genus name, *Spinops*, means “spine face,” referring to the horns on the skull of the animal.

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The species name, *sternbergorum*, honors the Sternberg family, particularly Charles H. and

Levi Sternberg, who discovered the fossils.

The Fossils

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Parts of at least two skulls of *Spinops* were discovered at a single site, within a few meters of each other in the same rock layer.

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Bones include two parietal bones (the central bone of the neck frill), a squamosal (the side bone of the frill), a face (including the nose horn, brow horns, and eye region), and part of a lower jaw.

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The parietal bones at the middle of the frill are unique to *Spinops*, preserving a forward-curving hook and a backward-pointing spike on each side. No other horned dinosaur has this combination of features, allowing confident recognition of *Spinops* as a new species.

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The skulls were disarticulated, meaning that they had fallen apart after death.

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We do not know for certain if the individuals of *Spinops* were living in a herd or social group at the time of their death, or if they just happened to be buried together.

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The original fossils of *Spinops* are in the collection of the Natural History Museum (London).

The Living Animal

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Based on comparison with its close relatives for which complete skeletons are known, *Spinops* probably weighed around 2 tonnes and measured roughly 20 feet (6 meters) in body length.

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Spinops was a plant-eater, living near the edge of an ancient seaway that covered the center of North America.

Relationships

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Spinops is a ceratopsid, or horned dinosaur. These herbivores were one of the dominant groups of dinosaurs that lived in western North America during the Cretaceous.

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The closest relatives of *Spinops* include *Centrosaurus* and *Styracosaurus*. The evolutionary relationships were determined by a careful comparison of the anatomy of the skull bones of various horned dinosaurs.

Age and Location

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The fossils of *Spinops* are roughly 76 million years old, from the Late Cretaceous.

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The age of the fossils was determined by analyzing fossil pollen from the rock encasing the bones. Pollen evolves rapidly through time, and so certain kinds of pollen can be tied to particular rock layers. The rock layers themselves are then dated using radiometric dating.

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The site of discovery was within Dinosaur Provincial Park , Alberta, Canada.

History of Discovery

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The fossils of *Spinops* were discovered in 1916 by Charles H. and Levi Sternberg, a father-and-son team of fossil collectors hired by the Natural History Museum, London.

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The Sternbergs, who had developed an excellent reputation as fossil hunters, were primarily tasked with collecting fossils for museum exhibits.

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During the summer of 1916, the Sternbergs discovered a dense accumulation of fossil bones from several individuals of a horned dinosaur. In a letter to London, Charles Sternberg noted that the fossils probably represented a species previously unknown to science.

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The fossils were shipped to London. Because the fossils were relatively incomplete compared to the complete skeletons that the museum had hoped for, museum staff were extremely disappointed with the shipment. Consequently, the fossils were never completely cleaned, and sat on museum shelves for decades.

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Several paleontologists (including the authors of the paper naming *Spinops*) saw the Sternberg collection in the mid-2000s, and recognized the importance of the fossils. The fossils were then completely cleaned for study shortly thereafter.

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In all, 95 years passed between the discovery of *Spinops* and its official naming.

The Scientists

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An international team of scientists studied *Spinops*.

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Andrew A. Farke , the paper's lead author, works at the Raymond M. Alf Museum of Paleontology and is an expert on horned dinosaurs.

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Michael Ryan , Cleveland Museum of Natural History, is an expert on horned dinosaurs.

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Paul Barrett , Natural History Museum (London), is an expert on herbivorous dinosaurs.

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Darren Tanke , Royal Tyrrell Museum of Paleontology, is an expert on horned dinosaurs and the history of fossil collecting in Alberta.

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Dennis Braman , Royal Tyrrell Museum of Paleontology, is an expert on fossil pollen (essential for determining the age of the fossils).

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Mark Loewen , University of Utah and Natural History Museum of Utah, is an expert on horned dinosaurs.

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Mark Graham, Natural History Museum (London), is an expert on fossil preparation, and cleaned the fossils of *Spinops* for study.

Other

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This study was funded in part by the National Science Foundation.

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The original study is published in a peer-reviewed scientific journal, *Acta Palaeontologica Polonica* .

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