Hybrid Animals

A Reading A–Z Level Z2 Leveled Book
Word Count: 2,335

LEVELED BOOK • Z²

Hybrid Animals

Connections

Writing

Write an informative article for a local paper on the science of hybrid animals. Include the benefits and challenges so readers are fully informed.

Math

Research five different hybrid animals not included in the text. Describe how the hybrids compare to their two parent species. Use glossary words in your description.

MULTI LEVEL Z·Z⁰·Z²

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Written by Cheryl Reifsnyder

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Focus Question

What are the pros and cons of interbreeding different species?

Words to Know

biodiversity
chromosomes
diverged
DNA
embryos
expediting
fertilize
genetic
hybrids
interbreeding
meiosis
offspring
reproduce
species
sterile
susceptible
test tube
transgenic

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Cover: A four-day-old zedonk—a rare cross between a zebra and a donkey—stands near her mom.

Title page: This wolphin is a cross between a bottlenose dolphin and a false killer whale. Even her teeth show that she is a hybrid: bottlenose dolphins have eighty-eight, false killer whales have forty-four, and she has sixty-six.

Page 3: This foal is a zebra-donkey hybrid.

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Correlation

LEVEL Z2	
Fountas & Pinnell	Y–Z
Reading Recovery	N/A
DRA	70+

Table of Contents

What Is a Hybrid Animal?

The ancient Greeks imagined creatures that were half one animal and half another—centaurs and minotaurs, griffons and manticores. These creatures may not exist, but animal **hybrids** do. They combine the traits of different **species**, and they are more common than most people realize.

A hybrid is an animal that has parents of two different species. For instance, horses and donkeys are different species, but they are similar enough in appearance and behavior that they can mate with one another. If the mother is a horse, the baby is called a *mule;* if the mother is a donkey, the baby is called a *hinny.*

When different species mate, they don't always create a hybrid. Parent species that are too different may not have live **offspring** or, if they do, the young may be weak or unhealthy. When two different species do produce healthy offspring, though—as in the case of the mule and hinny—the young usually have a combination of the parent species' characteristics. The more closely the parent species are related, the more likely it is that they will be able to have healthy hybrid offspring.

Similar, but Not the Same

Female Parent		Male Parent		Offspring
Horse	×	Donkey	=	Mule
Donkey	×	Horse	=	Hinny

Hybrid animals often have different names depending on which species acted as which parent. That's because the characteristics of the hybrid animal are often determined by which species was the mother. In the case of donkey-horse hybrids, mules are generally larger and hardier than hinnies.

mule

Like many hybrid animals, mules and hinnies are **sterile**—unable to make sperm or eggs to produce offspring. This situation stems from the fact that different species of animals often have different numbers of **chromosomes**. Mules and hinnies receive nonmatching **genetic** information from their horse and donkey parents: thirty-two horse chromosomes from one parent and thirty-one donkey chromosomes from the other.

By contrast, non-hybrid animals end up with a matched set of chromosomes. For instance, a horse receives one set of thirty-two chromosomes from Mom and another set of thirty-two from Dad, making two copies of every chromosome in each of the horse's cells. A donkey receives thirty-one from each parent, also ending up with two copies of every chromosome in each of its cells.

In a hybrid animal, though, Mom's chromosomes are different from Dad's. A mule doesn't have two copies of anything—just a jumble of sixty-three chromosomes, none of which have matches.

The mule's chromosomes don't need to form matched pairs for normal cell division: the chromosomes simply form copies of themselves and sort one copy into each of the new cells. However, when the mule tries to make reproductive cells, those unmatched chromosomes cause problems.

Unlike most cells, sperm and egg cells have only one copy of each chromosome. Getting to that one-copy state requires a process called **meiosis**, which requires each chromosome to line up with its match so one member of each pair can be sorted into separate cells.

Since the horse and donkey chromosomes don't look very much like one another, they can't form nice pairs. The dividing cell has a hard time sorting the right chromosomes into the right places; some offspring cells receive too many chromosomes and others receive too few. These cells rarely survive.

Human-Made Hybrids

Sometimes people breed hybrids intentionally, hoping to produce a hybrid that has the best qualities of both parent animals. Mules have been deliberately bred since ancient times because they are hardier and more sure-footed than horses. Mules are also easier to care for than horses—less likely to overeat, less **susceptible** to heat, and less prone to leg injuries.

Zebra hybrids, sometimes called *zebroids*, are a more recent type of hybrid. Zebras are wild animals that are difficult to train for riding or carrying packs, but they aren't susceptible to the same diseases as domesticated equines. Zebroids inherit a gentler personality from their domesticated parent as well as resistance to disease from their wild parent.

Beefalo, another recent hybrid, were created to combine the traits of buffalo (bison) and domesticated cattle. Buffalo are hardier than cattle and produce meat lower in fat than standard beef. However, buffalo are difficult to handle and can sometimes be dangerous.

Beefalo are as easy to handle as ordinary cattle but are much hardier and easier to care for. They have an efficient digestive system, which allows them to eat leaves and bushes as well as grass. Unlike cattle, they are able to withstand both hot and cold temperature extremes. Like buffalo, their meat is low in fat, with more protein than standard beef. Unlike zebroids or mules, beefalo are able to **reproduce**, as long as breeders are mindful of their math. It turns out that the ratio of three-eighths bison to five-eighths cow is ideal. As long as the proportion of bison is kept at or below the three-eighths level, there are few—if any—reproductive problems.

A *liger*, which is a hybrid of a male lion and a female tiger, looks like a supersized lion with faded tiger stripes. Ligers grow about twice as large as either parent species, with Hercules, the world's biggest male liger, weighing in at nearly 1,200 pounds (544 kg)! They are usually tawny colored, like lions, but with pale bellies, like tigers. A similar hybrid, the *tigon*, is created by breeding the opposite genders of parents—a female lion and a male tiger.

Hercules, the world's biggest cat, poses with his little brother Aries. Both are ligers.

Ligers never occur naturally since lions and tigers live in different habitats. However, these strange mixes can draw a crowd, and although accredited zoos avoid **interbreeding** the big cats, both independent breeders and exotic animal preserves have tried their hand at making money from them. Breeders have created other big cat hybrids as well: *leopons* (leopard × lion), *jaguleps* (jaguar × leopard), and *lijaguleps* (lion × jagulep). The males of these hybrids are usually sterile, but the females are usually able to bear offspring.

Until recently, people could only obtain hybrids of similar species that might be willing to mate with each other. Other species, while somewhat similar, were unwilling. For instance, even when given the opportunity, camels and llamas would rarely mate. However, modern

Hybrid	Parent Species (Female, Male)	Characteristics
Mule	Horse × Donkey	• Size and strength of a horse • Endurance, hardiness, and sure-footedness of a donkey
Hinny	Donkey × Horse	• Like a mule, but smaller and less hardy
Beefalo*	Bison × Bovine * Ideal ratio: 3/8 bison and 5/8 cow	• Cattle-like temperament • Buffalo-like in that they are hardier, have a more efficient digestive system, and yield lower-fat meat
Zedonk	Zebra × Donkey	• Disease resistance of a zebra • Temperament midway between a zebra's and a domestic animal's • Striking appearance that is a combination of the parent species' look
Zorse	Zebra × Horse	
Zony	Zebra × Pony	
Liger	Tiger × Lion	• Tawny coat like a lion, partial stripes, mane on some males • Larger than either parent
Tigon	Lion × Tiger	• Tiger-sized, appearance midway between a tiger and lion
Savannah Cat	Domestic house cat × African serval	• Larger than domestic house cat, long legs, serval-like fur pattern • More dog-like in their behavior
Cama	Llama × Camel	• Strong, but smaller than a camel • Better temper and easier to handle than a camel

medicine provided a way to **fertilize** eggs in a **test tube** instead of inside an animal. As a result, the first camel-llama hybrid—the *cama*—was born. Scientists hope the cama will couple the camel's hardiness and strength with the llama's calmer disposition.

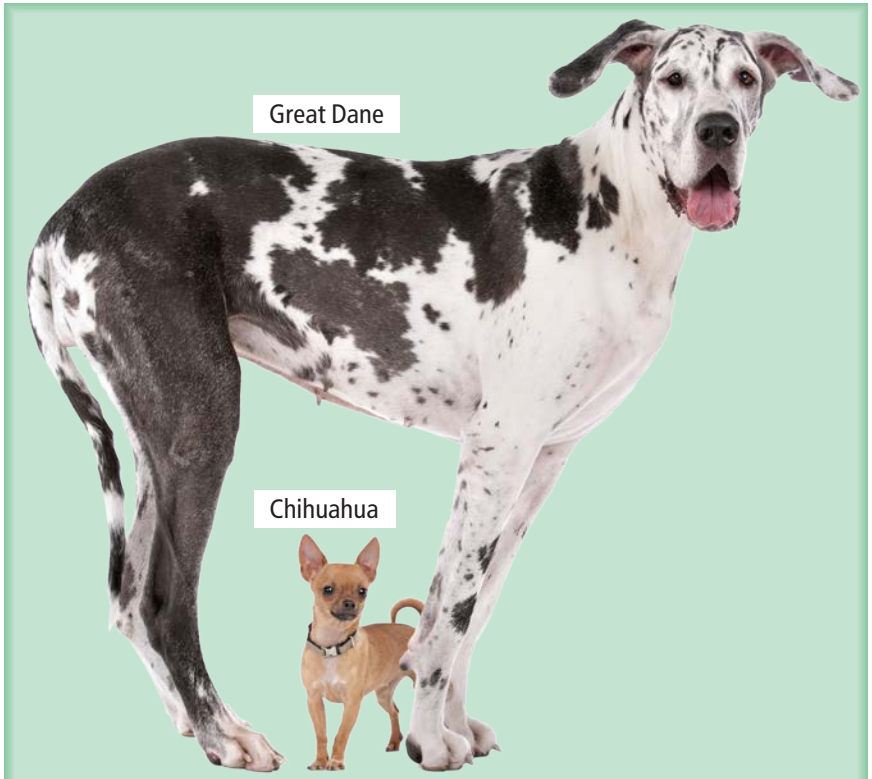
Natural Hybrids and the Tricky Definition of Species

You might have the impression that hybrids only occur when humans breed them intentionally, but that's not the case. Hybrids can arise whenever related animal species interbreed—which can happen any time they live and interact in the same environment.

It can be surprisingly difficult to identify which animals are hybrids, though, because it can be surprisingly difficult to define what constitutes separate species.

Scientists often define a species as a group of individuals with two important characteristics.

1. They have the potential to interbreed in nature.
2. They can produce viable offspring if they do interbreed—that is, their offspring are healthy enough to produce offspring of their own.

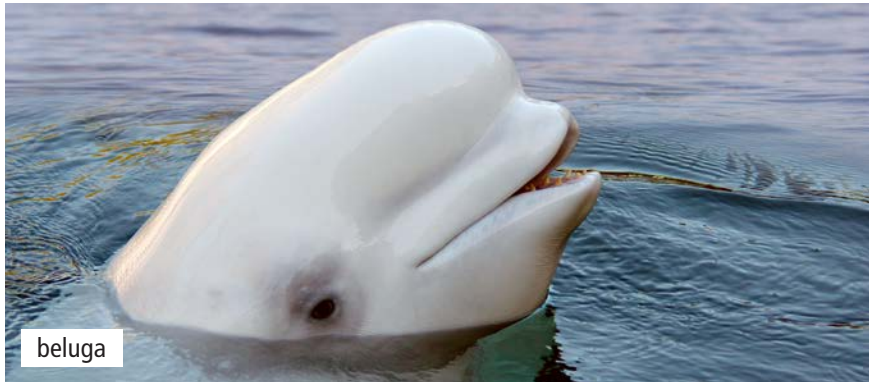


Same or Different Species?

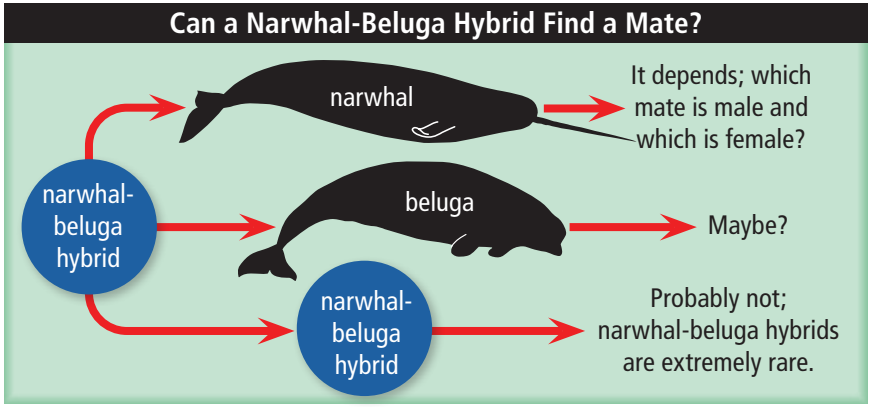
It can be difficult to tell whether two animals are the same species based on appearance alone. These two dog breeds look quite different from one another, but they are considered the same species—*Canis lupus familiaris*. Two fruit flies may look like twins but actually be different species.

Under this definition, most hybrids don't qualify as separate species because they cannot reproduce. Some are unable to reproduce because they're sterile, like mules, but even hybrids that can make reproductive cells may not be able to have offspring.

Take the narwhal-beluga whale hybrid spotted off the coast of Greenland in 2009. Scientists don't know whether it is biologically capable of producing reproductive cells, but even if it can, it needs a mate to produce offspring. Narwhal-beluga whale hybrids (narlugas? barwhals?) are rare, so it is unlikely to come across another of its kind. Also, a male hybrid may not have much success mating with a female narwhal because it lacks the male narwhal's characteristic spiral tusk—which turns out to be an important factor when a female narwhal chooses a mate.


beluga


narwhal



In other cases, the line between hybrids and distinct species is trickier to determine. *Ring species* provide a great example of this situation.

To understand ring species, imagine a group of preschoolers sitting in a circle. Each preschooler represents a separate species sitting within arm's reach of two others. Now imagine them playing a game of telephone. The first child whispers something to the second, who whispers to the next, and so on until the last child gets the message, which is usually something completely different from the starting words.

The changes in the whispered message are similar to the changes you see around a circle of ring species: each species is similar to those on either side, until you reach the point where the circle's ends overlap. Any two adjacent species in a ring species group are similar enough that they can—and do—interbreed, until the overlap point.

Seven Salamanders

The *Ensatina* salamanders of California all descended from the same Oregon ancestors. As the species spread southward, it adapted to specific, varied environments and evolved into distinct species that formed a ring around the San Joaquin (wah-KEEN) Valley. These species all have slight differences but are similar enough to interbreed with their immediate neighbors—except at the point where their extremes overlap. In southern California, *Ensatina eschscholtzii* and *Ensatina klauberi* do not interbreed. The ring is broken.

When Species Overlap

Evidence suggests that ring species members have changed slowly as they have adapted to specific environmental conditions. Their ranges overlap in some regions; where they do, hybrids arise. With far more of each parent species than the hybrids, though, these hybrids do not greatly influence the parent populations.

Sometimes, though, two species that were isolated from one another are brought together abruptly. In this situation, hybrids can cause problems for their parent species. They may compete for food, territory, or other resources. They may compete for mates. They may even change the genetic makeup of one or both of the original species.

Over the past decades, changing environmental conditions have brought together numerous species that were previously separated. Climate change has had its greatest effects in the Arctic, which is warming two to four times faster than the rest of the world. Animal species native to the Arctic region are changing their natural ranges in response to rising temperatures and melting sea ice. Animals from farther south that might have previously found northern regions too cold are extending their ranges northward.

As a result, species that used to be geographically separate—such as grizzly and polar bears—are now interbreeding. One of the first grizzly-polar bear hybrids, called a *grolar bear*, was spotted in 2006. The bear had thick white fur, brown legs and paws, and a wide grizzly-like head. Other grolar bears have been identified since, with increasing frequency, which suggests that grizzlies and polar bears are interbreeding fairly frequently in the wild. At least one was a second-generation hybrid, which indicates that the hybrids are able to reproduce.

While not a confirmed grolar bear, this bear's body shape, short neck, and odd face (when compared to other polar bears) suggest that it is a grizzly-polar hybrid.

What's the Big Deal?

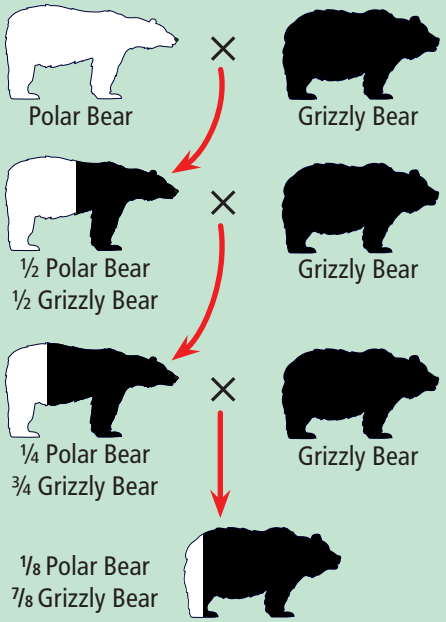
So grizzlies and polar bears might have some little brown-and-white grolar bear cubs. Is that really a big deal?

If there were plenty of polar bears and grizzly bears roaming the world, the answer might be no, a few hybrids wouldn't be a big deal—especially if hybrids only occurred in a few areas where the bears' ranges overlapped. The problem is that polar bears are at risk of going extinct. When there aren't that many of a species to start with, every birth makes a difference. Every polar bear that breeds with a grizzly is a polar bear that isn't bringing more polar bears into the world.

It becomes a numbers game. The more polar bears that interbreed with grizzly bears, the more their genes—specialized for surviving in the harsh Arctic environment—get diluted by grizzly bear genes. Eventually, polar bears might simply disappear.

On top of that, grolar bears may not be very well adapted to either of their parents' environments. Grolar bears in a German zoo seem to have a polar bear's instinct for seal hunting but not its strong swimming ability. Do these hybrids survive as well as non-hybrids in the wild? At this point, no one knows.

The Problem with Hybrids and Threatened Species



If one species greatly outnumbers another, hybridization can overwhelm the one with fewer numbers. Every time a polar bear or polar bear hybrid breeds with a grizzly, the polar bear genes become further diluted. Unless polar bears breed with other polar bears as much as—or more than—they breed with grizzlies, they could simply disappear.

Although hybrids are often sterile, scientists expect that many arctic mammals—grizzly and polar bears, seals, sea lions, and walruses, to name a few—will be able to interbreed successfully with their southern cousins. In fact, scientists recently published a list of thirty-four hybrids of arctic mammals that are likely to occur as climate change brings formerly isolated species into contact. Because northern animal species **diverged** from their southern relatives fairly recently in evolutionary terms, it is likely that many of the hybrids will be fertile.


southern flying squirrel

Flying Squirrel Invasion!

The Arctic isn't the only region where animal species are beginning to bump into one another. In Ontario, Canada, southern flying squirrels seem to be taking advantage of the warmer climate to expand their range northward—into the domain of their cousins, the northern flying squirrels.

The southern flying squirrels are smaller, with white belly fur; the northerners have gray-and-white belly fur; and the hybrids, as you might expect, have a mash-up of the parents' traits. Scientists studying one band of northern squirrels say that 4 percent of the animals in the group are now hybrids of the two species. Obviously, these squirrels are similar enough genetically that the hybrids are able to reproduce!

Creatures by Design

What if you want a hybrid animal that combines traits from species so different that even mating in a test tube won't work? How about these traits: the ability to produce spider silk (an ability unique to spiders) and the ability to produce large quantities of milk (an ability limited to mammals)?

Spider silk is one of the strongest fibers in the world—stronger and more flexible than steel or Kevlar. It's also hypoallergenic and has antimicrobial properties, making it ideal for use in medicine. The fine, nearly invisible thread could be used during eye surgery, for example, or even to create artificial ligaments. Unfortunately, a single ounce of spider silk requires fourteen thousand spiders—and since spiders tend to eat their neighbors, large-scale "spider farms" are out of the question.

Since standard animal hybridization techniques won't work for species that are too different from one another, scientists used genetic engineering techniques to insert silk proteins from the golden orb weaver spider into goat **DNA**. Goats then produce the spider silk proteins in their milk, and scientists extract those proteins in the lab. The process and results are still imperfect, but researchers hope to engineer goats that can produce useful amounts of spider silk someday.

These "spider kids" are twins: Armstrong (left) and Sweet Pea (right).

Since spider genes were artificially introduced—inserted into goat **embryos** in the laboratory—"spider goats" are considered **transgenic** rather than hybrid animals.

Animal Hybrids: Problem or Solution?

In the past, scientists thought that animal hybrids represented an evolutionary dead end. Most hybrid offspring were sterile, and while the parents were probably well adapted to their specific environments, by combining their characteristics, the hybrid would end up adapted to neither. In most cases, this is exactly what we see in nature: hybrid species tend to be poorly adapted to their environments and often fail to survive and reproduce.

However, when animals face drastic environmental changes, the process of evolution may occur too slowly for species to adapt to changing conditions. Hybrids provide a way for two species to exchange genetic information, potentially combining it in new and useful ways.

Are hybrid animals a threat to **biodiversity** in the world today? Or are they nature's way of **expediting** the process of adaptation in the face of rapidly changing environmental conditions? They may be a bit of both—only time will tell!

Glossary

biodiversity *(n.)* the variety of life forms on Earth or in a specific habitat or ecosystem (p. 22)

chromosomes *(n.)* rod-shaped structures inside cells that carry genes (p. 5)

diverged *(v.)* moved apart from the same point; became different (p. 19)

DNA *(n.)* a code that carries genetic information about a living thing; abbreviation of deoxyribonucleic acid (p. 21)

embryos *(n.)* unborn offspring in the early stages of growth (p. 22)

expediting *(v.)* speeding up something, especially a process (p. 22)

fertilize *(v.)* to combine male and female reproductive cells to create a new animal or plant (p. 11)

genetic *(adj.)* having to do with heredity and variation in living things (p. 5)

hybrids *(n.)* offspring produced from two different parent types, breeds, or species (p. 4)

interbreeding *(v.)* mating two different species of animals to form offspring with a combination of traits from each parent; crossbreeding (p. 9)

meiosis *(n.)* the process of cellular division that reduces the number of chromosomes to half, producing reproductive cells that contain one of each pair of homologous chromosomes (p. 6)

offspring *(n.)* a person's child or another animal's young; descendants (p. 4)

reproduce *(v.)* to make offspring that are similar to the original living thing (p. 8)

species *(n.)* a group of living things that are physically similar and can reproduce (p. 4)

sterile *(adj.)* not able to produce offspring (p. 5)

susceptible *(adj.)* easily affected or influenced; vulnerable (p. 7)

test tube *(n.)* a narrow glass tube that is closed at one end and open at the other end, commonly used in scientific laboratories (p. 11)

transgenic *(adj.)* of or relating to an organism whose DNA has been altered by the transfer of genes from another species or breed (p. 22)