Name _____ Date _____ Period _____

What is a Species?

Read the following article and ANNOTATE it using the annotation guide provided and annotation strategies you know. Then answer the questions at the end of the article.

The mating game: ligers, zorses, wholphins, and other hybrid animals raise a beastly science question: what is a species?

by Sharon Guynup

What has a mane like a lion, the sleek muscular body of a tiger, stripes and spots, and weighs up to 1,000 pounds? Answer: A liger. The punch line sounds like a joke, but ligers--produced by a female tiger mating with a male lion--are actual animals and one of the world's more bizarre-looking hybrids, or mixed animal species.

If these ferocious cats met in the jungle, a tiger would probably not choose to visit a pride of lions; a raucous brawl--not romance--would be the more likely result. But with little choice in captivity--like an open zoo--the odd coupling may occur. In the wild, animals rarely interbreed for one potent reason: The offspring are usually infertile, or unable to reproduce--which can spell extinction for a species. "Infertile offspring don't pass on their genes [hereditary instructions in all cells] to the next generation," says University of Maine biologist Judith Rhymerat.

But even more threatening to species preservation are hybrids that can reproduce. For example, over the past decade Midwestern barred owls have pushed westward to the Pacific coast where they've settled in the forest habitat of endangered spotted owls--and bred with them to create sparred owls. "It's a nasty situation," says Susan Haig, a wildlife ecologist at Oregon State University.

Hybrids can result in loss of genetic diversity, she explains, and there's no protection for them under the 1973 Endangered Species Act. By traditional species' definition--in which organisms with common traits breed to create fertile offspring--they shouldn't be mating: Sparred owls could trigger the Northern spotted owl's extinction.

BREEDING BARRIERS

While ligers are rare, some animals in captivity are deliberately interbred for greater strength or endurance, like mules (horse donkey) and zorses (horse zebra). They're also interbred for food, like the beefalo (cow buffalo) and different types of catfish and trout. Russians crossbreed dogs with jackals to create a hybrid whose superior sense of smell, for example, is put to the test sniffing out bombs in Moscow's airports.

But why don't distinct wild animal species--like lizards and frogs, or cougars and elephants--mate of their own accord? The answer: Nature imposes breeding barriers, safeguards to protect individual species and help them adapt to their environment. Animals evolve, or develop unique traits over time, to ensure their survival. So specific genes that help a species adapt to a particular climate, eat what's on the local menu, and fight off neighborhood

predators, are passed on to the next generation. Mixing genes through interbreeding can eliminate survival traits--or result in infertile offspring.

To produce fertile offspring, scientists think chromosomes (cell structures that house all the genes) from both a mother and father may need to pair off evenly during meiosis, a process of cell division that produces sex cells. For the hardy mule, for example, this is impossible, since its father--a donkey--has 62 chromosomes and its mother--a horse--has 64. When the two animals mate, each contributes half its chromosomes to the mule. In turn, the mule is almost always sterile because it inherits a total of 63 chromosomes, a number that can't divide into pairs (see diagram, below).

Sometimes the main breeding obstacle is a simple difference in habitat or breeding area--one species may fare better in thick jungles, another in wide-open spaces. And even if separate species do mate--and a female's egg successfully fertilizes, or fuses, with a male's sperm--the parental genes must partner perfectly to develop a healthy embryo (living organism in its earliest stages of development). "Genes need to turn on and off at the right time, in the right places--millions of times--in order to form limbs and other body parts," notes Eric Hallerman, a geneticist at Virginia Polytechnic Institute and State University. "If they don't, the embryo dies or becomes grossly malformed--and then dies." The off-and-on gene sequence isn't the same in all species, because different species possess different genes--which means they don't coordinate properly.

Besides infertility, blindness, faulty hearts, and brief life spans are routine disorders for many hybrids. Case in point: When a 400-pound Atlantic bottlenose dolphin and a 4,000-pound false killer whale mated off the coast of Hawaii, their wholphin offspring died at age 5, decades younger than the average 40- to 50-year life span of its parents.

RULE BREAKERS

Many of today's newly created creatures would confuse 18th-century Swedish naturalist Carolus Linnaeus, who developed the Linnaean taxonomic, or classification, system for the natural world. Within this system, taxonomists have identified and grouped about 2 million plant and animal species based on similarities and differences. But how exactly do you define a species? "That's one of the biggest questions in science," says Rhymer. "It's what everyone is arguing about."

Traditionally, a species is a group of organisms that share at least one unique characteristic, can interbreed to produce fertile offspring, and rarely reproduce with organisms of another species. But what to make of fertile hybrids like the sparred owl? "The old definition of a species doesn't really work today," Rhymer says. "We know of related species separated by millions of years that still have the ability to reproduce successfully."

One such example: the canid family--wolves, coyotes and dogs--whose common forebear is the fox-size Eucyon that roamed prehistoric Earth around 4 million years ago. From the carnivorous Eucyon arose three distinct species of various body sizes and shapes--with different hunting and feeding habits. And unlike most related but distinct species, such as the horse and donkey, the canines share enough genetic similarities to produce healthy, fertile pups.

SMART MATING

Interbreeding doesn't always spell doom. When Florida's panther population plummeted to fewer than 30 during the 1980s, the animals began inbreeding, mating among direct relatives who share remarkably similar gene sets. Inbreeding, which greatly increases the odds of birth defects, spawned cubs with crooked tails, heart defects, and other medical problems. In other words, it made the panther population dangerously unfit for survival. To widen the gene pool--the total collection of genes in a species--the U.S. Fish and Wildlife Service (USFWS) brought in a closely related subspecies, the Texas cougar.

Today, panthers' numbers have shot up to at least 78, and females are birthing healthy, fertile hybrid cubs. Still, Rhymer calls the hybridization effort a last desperate attempt to save some fraction of the panther gene pool. "The USFWS could either have hybridized the Florida panther or let it go extinct."

Hybridization can be a natural evolutionary process, explains Nina Fascione of the Defenders of Wildlife organization. "But problems arise when it's human-caused," she says. Leveling forests forces organisms to search out new homes and breaks down natural barriers, allowing animals to encroach on each other's habitats, as in the case of the spotted owl.

For now, the USFWS is still wrestling over a federal policy on the status of hybrid species--especially those that threaten endangered species. "As habitats become more fragmented, we're going to find more and more examples of hybrids, and it's going to be a prime problem for conservationists," warns ecologist Sue Haig.

INTERSPECIES MATING: DOES IT ADD UP?

Breeders mate horses and donkeys to get mules. The hybrids are stronger than their parents but unable to reproduce. Here's one theory why.

1 To create a mule, the female horse donates half of her 64 chromosomes. The male donkey donates half of his 62 chromosomes.

2 At the start of meiosis, a cellular division process that creates sex cells, chromosomes align and pair off.

3 Normally, meiosis produces four genetically unique daughter cells. But the mule has an odd number of chromosomes that cannot properly divide.

REASONS WHY DIFFERENT SPECIES RARELY MATE

GENETIC Different species have different genes; chromosomes must align during meiosis.

BEHAVIORAL Species may not understand each other's mating and "courting" language.

PHYSICAL Reproductive organs may not be compatible.

CHEMICAL Unique hormones (chemical messengers) that help sperm (male sex cells) penetrate an egg (female sex cell) vary between species.

IMMUNOLOGICAL The immune system recognize sperm from another species as foreign and kill it.

Answer the following questions using the article you read.

1. Define hybrid species and include at least two examples.

2. Why did scientists choose the Texas cougar to breed with the Florida Panther?

3. Why is creating hybrid cubs beneficial to the Florida Panther population?

4. List at least one other hybrid cross created by humans and list the reason why this hybrid was created.

5. Give at least TWO reasons why different species rarely mate.

6. Why are most hybrid species infertile (unable to have offspring)?