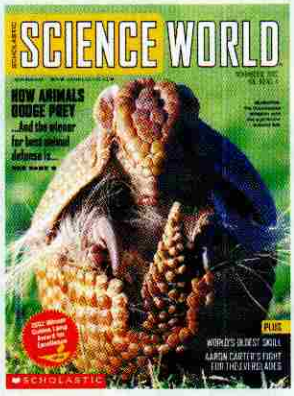
AWARD-WINNING SURVIVAL SKILLS

HOW ANIMALS ELUDE PREY



It's a dog-eat-dog world out there—not to mention a snake-eat-lizard world. To survive and reproduce, every creature must avoid becoming another predator's meal. But how to elude a hungry hunter who's bigger or faster than you?

Animals use some positively award-worthy strategies called *defenses*. "An animal's defenses are all that stand between being alive and being eaten," says biologist Tom Tregenza at the University of Leeds in the UK. The newly discovered mimic octopus, for example, fools marauders by impersonating an entire cast of less tempting prey. The flexible three-banded armadillo rolls itself up into a ball as impenetrable as an armored truck.

How did such an audacious array of animal defenses evolve in the first place? "In any large population there will be some variation," says biologist Ralph Turingan at the Florida Institute of Technology. Members of a species develop slightly different *traits* (physical characteristics): One armadillo might possess more flexible armor than another. If an individual is lucky enough to possess a trait that saves it from being devoured, the animal may live long enough to reproduce and pass the trait on to its offspring. "Eventually that trait will become dominant in future generations," Turingan says. The theory is called *natural selection*. In a nutshell, life forms best suited to their environment survive over the long haul.

To learn more about some of nature's award-winning defenses, read on . . .

by Lea Winerman

BEST SPECIAL EFFECT

The three-banded armadillo

PRIZE FACT

Three-banded armadillos sport supreme design: They use hinged bands to roll themselves up into a ball.

Note to Hollywood special-effects creators: If you need to devise ingenious strategies for heroes to protect themselves against bloodthirsty attackers, take inspiration from the three-banded armadillo. While all armadillos sport leathery armored shells to fend off prey like ravenous wildcats, "three-banded armadillos are the only ones that curl themselves into completely enclosed balls," says Southwest Missouri State University biology professor Lynn Robbins.

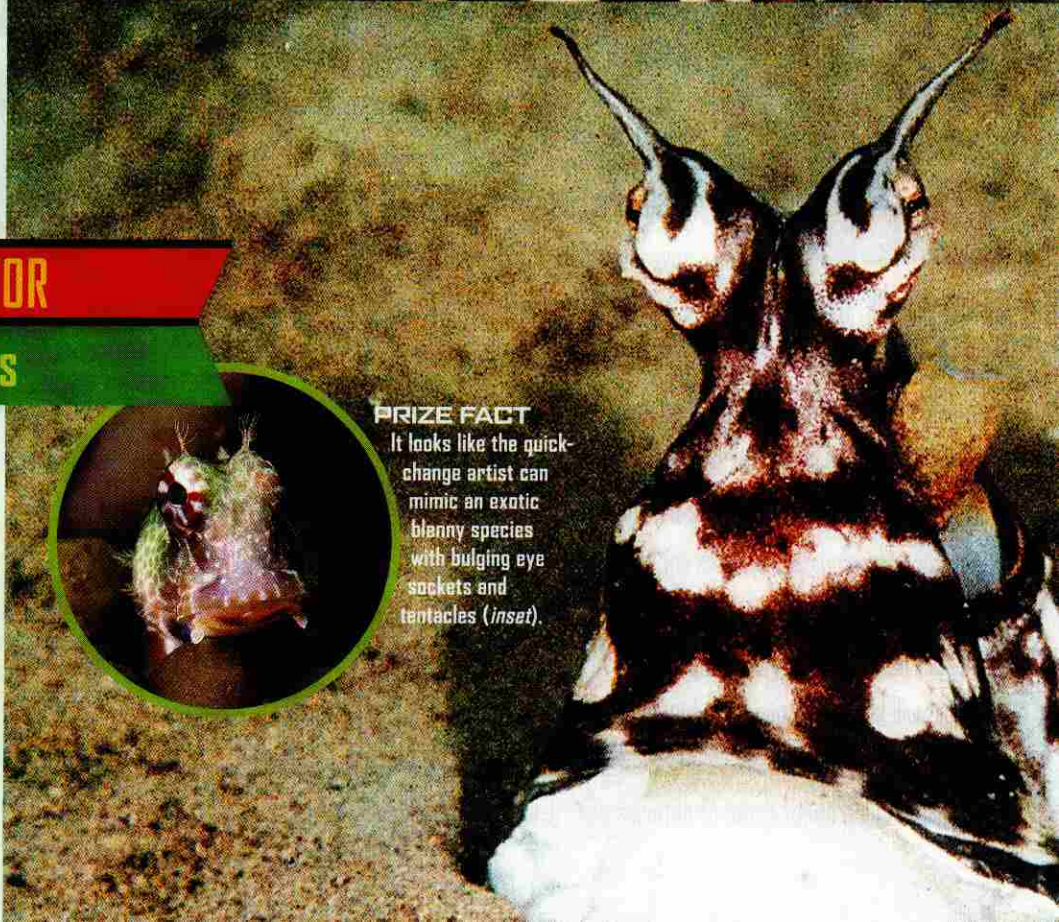
The three-banded armadillo (*Tolypeutes tricinctus*) and southern three-banded armadillo (*Tolypeutes matacus*) live in South America. Their body shields consist of bony plates and a layer of *horn* or *keratin*, fibrous proteins that make up tissues such as hair and nails; the plates themselves are formed by *ossified* or hardened skin. On their shells, three hinged bands give them the flexibility to roll themselves up. Since the shoulder and haunch plates aren't attached on the sides to the armadillos' skin, there's plenty of room inside to fit a head, legs, and tail. (The shells are also good insulators—they trap heat to help keep the creature active in winter.)

When threatened, armadillos curl up and leave only a tiny peephole from which to peer out at their predator. If touched, they snap totally shut. However, some fierce jaguars have been known to use their savage teeth and claws to crack open a tasty armadillo! Even the most dazzling special effects have their limits. . . .

PRIZE FACT
The mimic octopus contorts its body and dresses in bright stripes to impersonate the poisonous lionfish (*inset*).

BEST IMPERSONATOR

The mimic octopus



PRIZE FACT
It looks like the quick-change artist can mimic an exotic blenny species with bulging eye sockets and tentacles (*inset*).

Do you know an undiscovered superstar—a natural talent who can mimic others on demand? For years, divers in murky waters off Indonesia snapped photos of an octopus—an eight-armed *invertebrate* (no backbone)—that seemed to impersonate a cast of marine animals through *mimicry*, or looking like another species. When a group of scientists got hold of the images, they hightailed it

LIONFISH, OCTOPUS (TOP), BLENNYFISH: ©DENISE TACKETT/REPRINTED WITH PERMISSION FROM BBC WORLDWIDE LTD.; OCTOPUS (BOTTOM): ©RUDIE KUITER/REPRINTED WITH PERMISSION FROM BBC WORLDWIDE LTD.; POSSUM: ©MICHAEL HABICHT/ANIMALS ANIMALS

to Indonesia last year to identify the extraordinary 60-centimeter (24-inch) long copycat—which they dubbed the mimic octopus.

Many animals mimic other creatures to turn off predators. The harmless milk snake, for example, resembles the poisonous coral snake with its bright red, yellow, and black bands. "But this octopus is the only animal we've found so far that can mimic more than one animal," says biologist Tom Tregenza at the University of Leeds. The octopus can ape at least three critters—the flatfish, lionfish, and sea snake, Tregenza's team claims. To mimic the flatfish, the lumpy octopus speeds up, yanks in all eight arms, alters shape and color, and ripples its body in a wave!

Why imitate a slew of creatures? One clue: While many octopuses live and hide in reefs or rocks, the mimic octopus slinks along seafloor mud in plain sight. "There's nowhere to hide," Tregenza says. Besides, adds team scientist Roger Hanlon, "an octopus is a soft, juicy hunk of protein that everything else out there wants to eat." Flatfish are far more populous and less likely to attract attention.

How does this superstar perform its tricks? It features a flexible body that twists into multiple forms and skin cells called *chromatophores*, which contain various colored pigments. Muscles around each chromatophore constrict or expand the cell—when constricted, skin color lightens, when expanded color darkens. The octopus alters color patterns by constricting and expanding thousands of chromatophores at the same time. Next stop, Warner Brothers?

PRIZE FACT
Is there a starring role in a *Die Hard* sequel for the pesky opossum? It also boasts a rare natural resistance to snakebite venom.

BEST ACTOR IN A DEATH SCENE

The opossum

Ever watch an actor croak—only to catch him breathing afterward? He should take lessons from the opossum, America's only *marsupial* (mammal that carries its young in a pouch). Many predators won't touch *carrion*, or dead animals. When threatened by wild dogs or coyotes, the slow-running opossum either heads for the nearest tree to climb or else "plays possum"—feigns death. It falls over, lies still on its side, eyes and mouth half open. Drool trickles from its mouth, its tongue lolling to one side. Most persuasive of all, it expels a green putrid-smelling substance from its anal glands. "Basically, it makes a big stinking mess," says University of Idaho biology professor Steven Austad. The opossum can remain in this state long enough for any predator to exit the scene. Now that's an Oscar-winning performance.

PRIZE FACT
When this pufferfish inflates in self-defense, its skin projects razor-sharp spines that cover the body—making it look pretty unappetizing.

BEST ACTION HERO

The spiny pufferfish

Ordinarily, the meek spiny pufferfish (*Diodon holocanthus*) drifts slowly in its native coral-reef habitats around the world. Its round body and small fins make it a sluggish swimmer—and perfect prey. But just try to eat it, and get ready to be BLOWN AWAY! When threatened, the puffer inflates to three times its normal size. "It just swallows water until its stomach is completely full," says biologist and pufferfish expert Ralph Turingan at the Florida Institute of Technology. How does the fish change shape? Its skin and stomach are super-stretchable. Also, it lacks a rib cage—no bones to impede an expanding stomach. Dare to swallow an uninflated puffer? "Sharks have actually died from a pufferfish inflating in their esophagus," says Turingan. Other predators who've witnessed Superman in action stay clear of the Big Puffer!

IT'S YOUR CHOICE

Choose the correct answer(s) to these questions:

1 Which process might cause animal defenses to change over time?

A kin selection **B** behavioral modification
C morphogenesis **D** natural selection

2 Which of the following would most likely explain why the mimic octopus impersonates several animals?

A The mimic octopus is a slow swimmer.
B It lives in plain sight of other prey.
C It has small eyes, which make it a poor hunter.
D Mimicry is part of its mating process.

3 Pufferfish belong to the same family—diodontidae—as porcupinefish and burrfish. Which defining feature do family members share?

A large fins **B** bright coloring
C spiny skin **D** small teeth

ANSWERS IN TEACHER'S EDITION

MOST OUTRAGEOUS PERFORMANCE

The tortoise beetle

Do you cheer for revolting onscreen characters? The *larvae* (immature form) of the tortoise beetle species *Hemisphaerota cynaea* may nab the Oscar for nature's most disgusting defense-maker. The palm-tree-dwelling bugs, which live in Florida and southern Georgia, cover themselves with an elaborately woven thatch of their own feces. They extrude strands of feces from an "anal turret," which swivels to shoot out the strands in all directions. The feces are dry, odorless, and chemically *inert* (inactive). Still, most predators won't go near the stuff. "People react with 'yuck,' and my guess is so do predators," says expert Thomas Eisner, a Cornell University *ecologist* (scientist who studies the environment). "There's a rule in nature: You don't mess with feces, because it can carry parasites and microbial diseases."

Unfortunately, no protection works 100 percent of the time. "If you look hard enough at the defense of any animal, somebody manages to crash through it," Eisner says. The adult carabid beetle chomps right through the fecal shield to reach tempting larvae underneath. "If an animal like the tortoise beetle is rejected by a lot of predators, it's an incredibly desirable resource to a hunter, because no one else is competing to eat the animal," says Eisner. "If you can crash through its defense, as the carabid beetle does, you've got it made." ■

PRIZE FACT
The tortoise beetle may boast nature's most outrageous defense. While most larvae leave excrement lying around, the tortoise beetle uses it to create a protective shield.

HANDS-ON SCIENCE

MASTER OF DISGUISE

Some animals escape predators by camouflage—concealing themselves by blending into their immediate physical environment. Follow this experiment to find out how they do it.

You Need:

1 small rock • 1 large photograph of any natural landscape (cut out one from a magazine) • construction paper • leaves • flower petals • colored pencils or markers • tape • glue • scissors • writing paper • pencil or pen

To Do:

1 Study the natural features of the photograph you selected. What would a species need to camouflage itself in the environment?

2 **GOAL** You have to hide your species (a small rock) in the photograph.

3 **RULE** You can select only three of these items to construct your species' (rock's) disguise: construction paper, leaves, flower petals, colored pencils or markers. (For example: 1 sheet of brown construction paper, 1 blue marker, and 1 maple leaf)

4 Use a pair of scissors, tape, and/or glue to dress your species' appearance.

5 Place species on the photograph. Observe, evaluate, and record how your species fits in the environment: What features allow it to either blend in or stand out in the habitat you chose?

6 Then take your species and place it on the photographs selected by your classmates. Observe, evaluate, and record how your species fits in or stands out in different environments.

Conclusions:

In what environment would your species be most or least fit for survival? Why? Discuss.

Take It Further:

Research and report on the area depicted in your photograph. What types of species live there? What kinds of defenses do they possess?