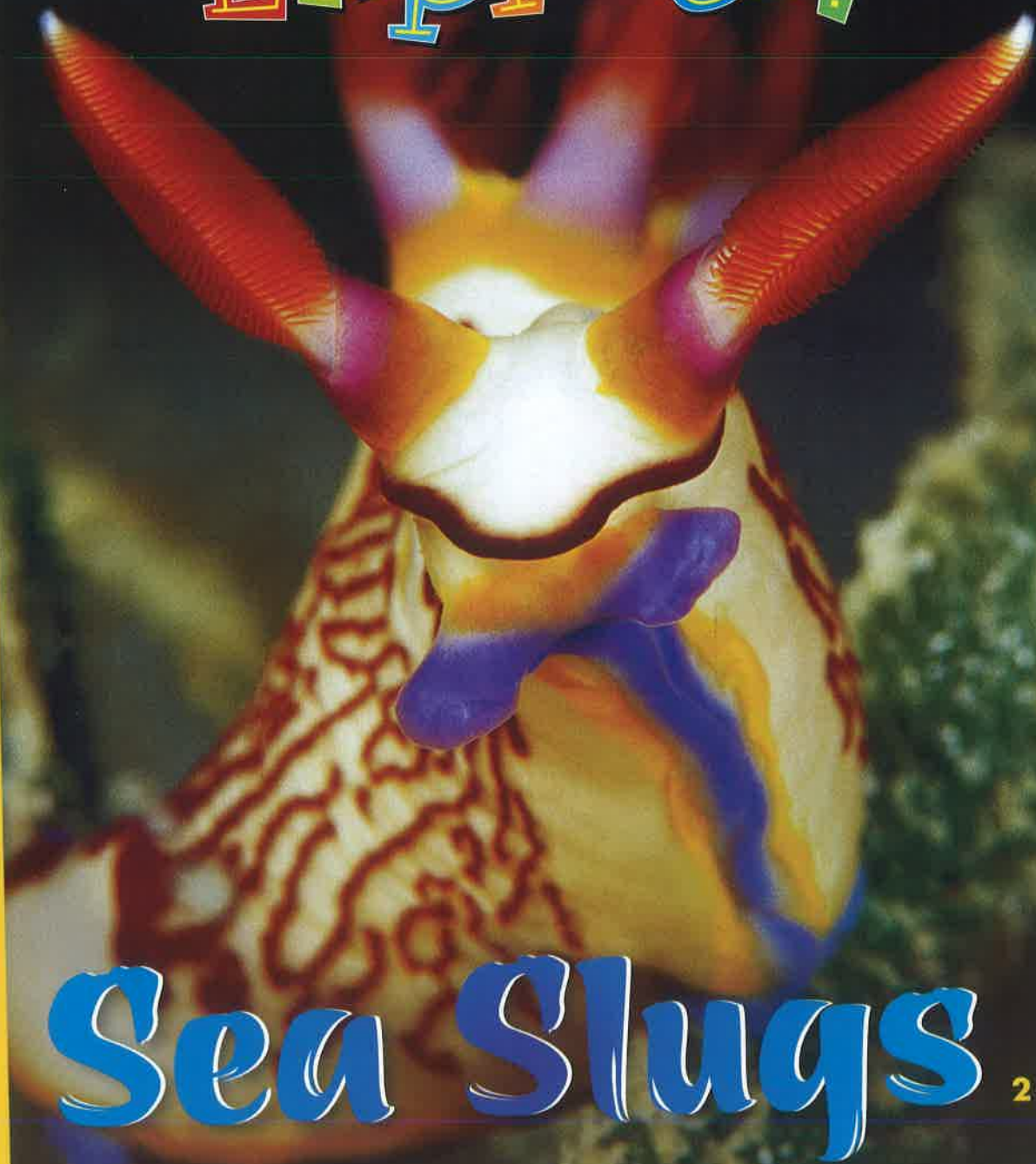


PIONEER EDITION

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NATIONAL GEOGRAPHIC Explorer!



Sea Slugs ²

Avalanches **8**

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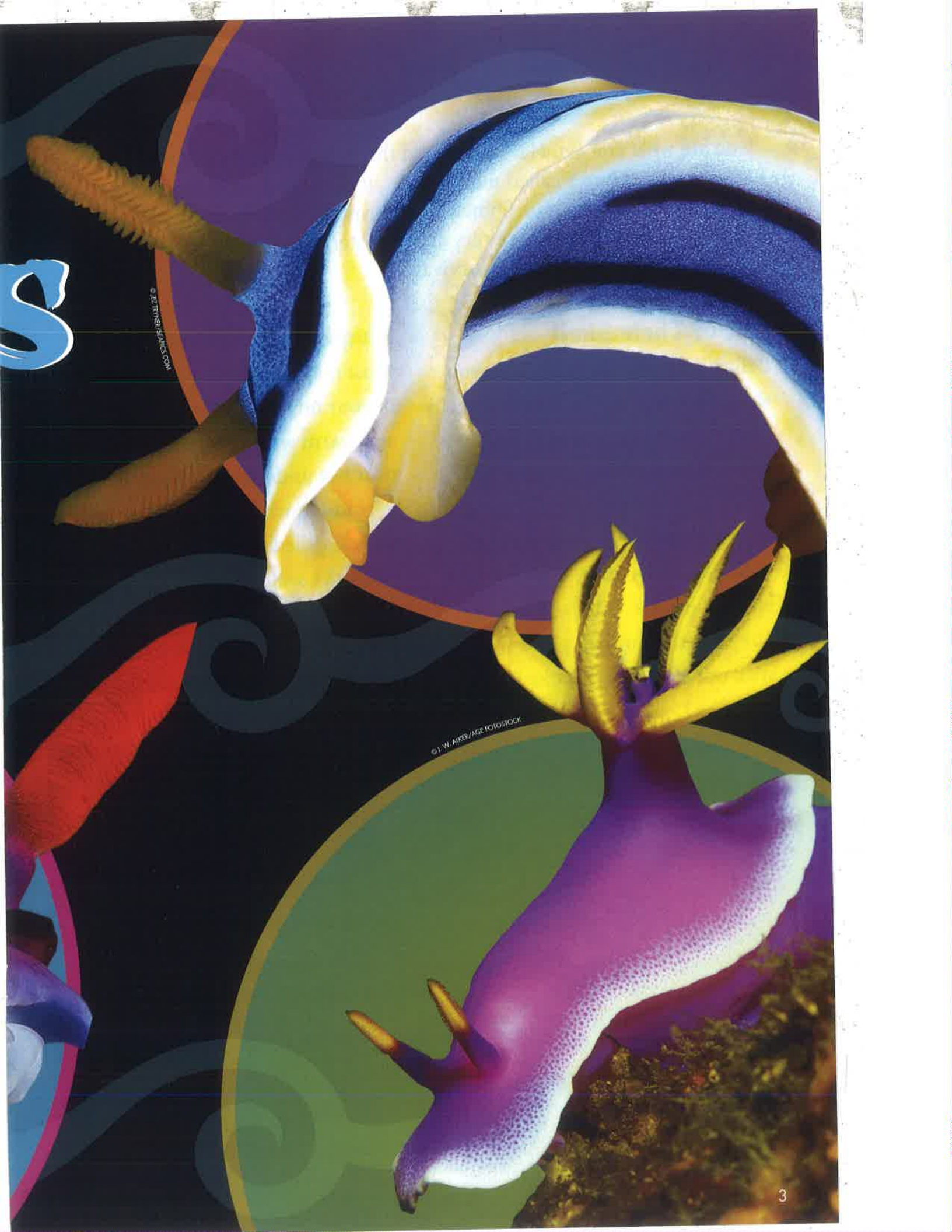
Reading Strategy: As you read this story, focus on what you want to remember. What information stands out?

Sea Slug

by Rebecca Paley

Dive into the underwater world of nudibranchs. Learn how they turn the food they eat into color, energy, and even weapons.





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You are what you eat. Have you heard that before? Food gives you energy. Well, for sea creatures called nudibranchs, food is more than just energy. Food makes them colorful. Sometimes it protects them from enemies.

Of course, nudibranchs are very choosy eaters. And it's no wonder. Their food holds the secrets to their survival.

Out of Their Shell

Before we get to the food facts, you should know a bit about nudibranchs. They are a type of sea slug. Sea slugs are mollusks. Clams, oysters, and snails are mollusks, too. All those animals have shells for protection.

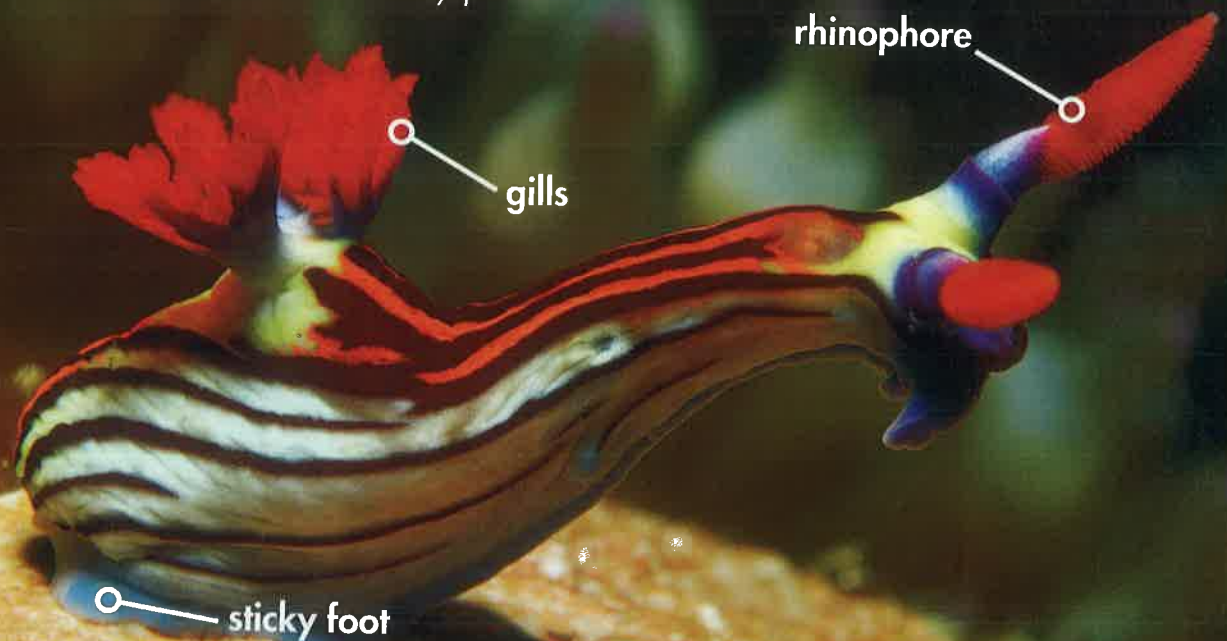
Nudibranchs don't. They are just blobs of muscle, skin, and organs. They breathe through **gills**. The gills stick out of their backs like feathers!

Slugs On the Move

Most nudibranchs are about the size of your finger. They live in both cold and warm waters. Some even live near hot underwater volcanoes!

Nudibranchs are slow. They use a muscle called a sticky foot to crawl along the seafloor. Some can swim. The Spanish dancer squeezes and releases its muscles to swim. It looks like a dancer's swishing skirt!

Soft Spots. A nudibranch has no shell to protect its soft body parts.



Living Color

Some nudibranchs are as colorful as a candy store. One type has pink dots and red gills. Another is blue with yellow and black stripes. Some are round. Others are long.

Now you're ready for the first food fact. Nudibranchs get their colors from their food! Nudibranchs dine on anemones, corals, and sponges.

When a slug eats a red sponge, it turns red. Matching the color of its food helps a nudibranch survive. A predator may not see a red slug eating a red sponge. Nudibranchs cannot see their own colors. They see only white, black, and gray.

A nudibranch doesn't have a nose, ears, or tongue. Instead, it has **rhinophores**. Sea slugs use them to smell, feel, and taste.



© GARY BELL/OCEANWIDEIMAGES.COM

Colorful Creatures. *This colorful pair rests on a sponge. Is it time to eat?*



© MIKE VETCH/AUAWY



© GUILLEN PHOTOGRAPHY/OW/INDONESIA/PAJAJA AMBAT/ALAMY

Spotted Sea Slug. *This nudibranch lives on a reef near Indonesia.*

Slug Sizes. *This species can be half a foot long. Most nudibranchs are smaller.*

Snack Attack

Ready for food fact number two? Nudibranchs can turn their food into weapons! Some eat stinging anemones. The stingers settle in the **cerata**. Those are parts some nudibranchs have for breathing and digestion. If attacked, the sea slugs can use the stingers as weapons!

That's not all. Some nudibranchs eat toxic sponges. The slugs save the poisons in their bodies. Then when an enemy is near, they let out a cloud of the poison. Spanish dancers even put the poison in their eggs. This protects their eggs until they hatch.

Some nudibranchs can't store poison. So they mimic ones that do! Predators can't tell the two species apart. So they leave them both alone.



Stolen Stingers. This nudibranch will use the anemone's stingers for defense.

Solar Power

Many nudibranchs eat only one kind of coral or anemone. It can be hard for them to find food. They might have to wait a long time between meals. No problem! Here's the last food fact. Some sea slugs make food *inside* their bodies. Here's how.

The blue dragon eats coral filled with tiny plants called algae. The slug saves the algae in its cerata. This is the secret to its survival.

Algae, like other plants, use sunlight to make food. This is called **photosynthesis**. Inside the slug's body, the algae keep using sunlight to make food. That food gives the nudibranch energy. Now it can go for days without eating!

Slug Studies

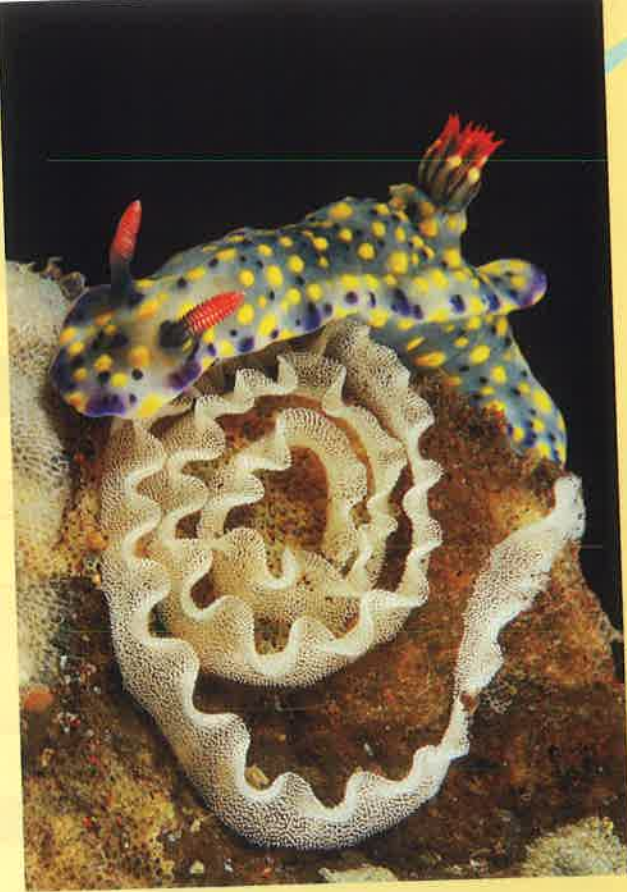
Scientists think nudibranchs are important to study. They want to know how nudibranchs are able to learn and remember things. This could help teach scientists more about how the human brain works.

The chemicals the slugs use may be important, too. They might help heal human organs. Imagine! Not bad for a little blob at the bottom of the ocean.



© DOUG PERRINE/SEAPICS.COM

Home Grown. The algae inside this blue dragon make food from sunlight.



DAVID DOUBILET/NATIONAL GEOGRAPHIC STOCK

Super Spiral. This nudibranch lays its eggs in a beautiful spiral pattern.

Wordwise

cerata: body part some nudibranchs use to breathe and digest food

gill: body part some animals use to breathe

photosynthesis: process by which plants use sunlight to make food

rhinophore: body part nudibranchs use to smell, feel, and taste



© GARY BELL/SEAPICS.COM

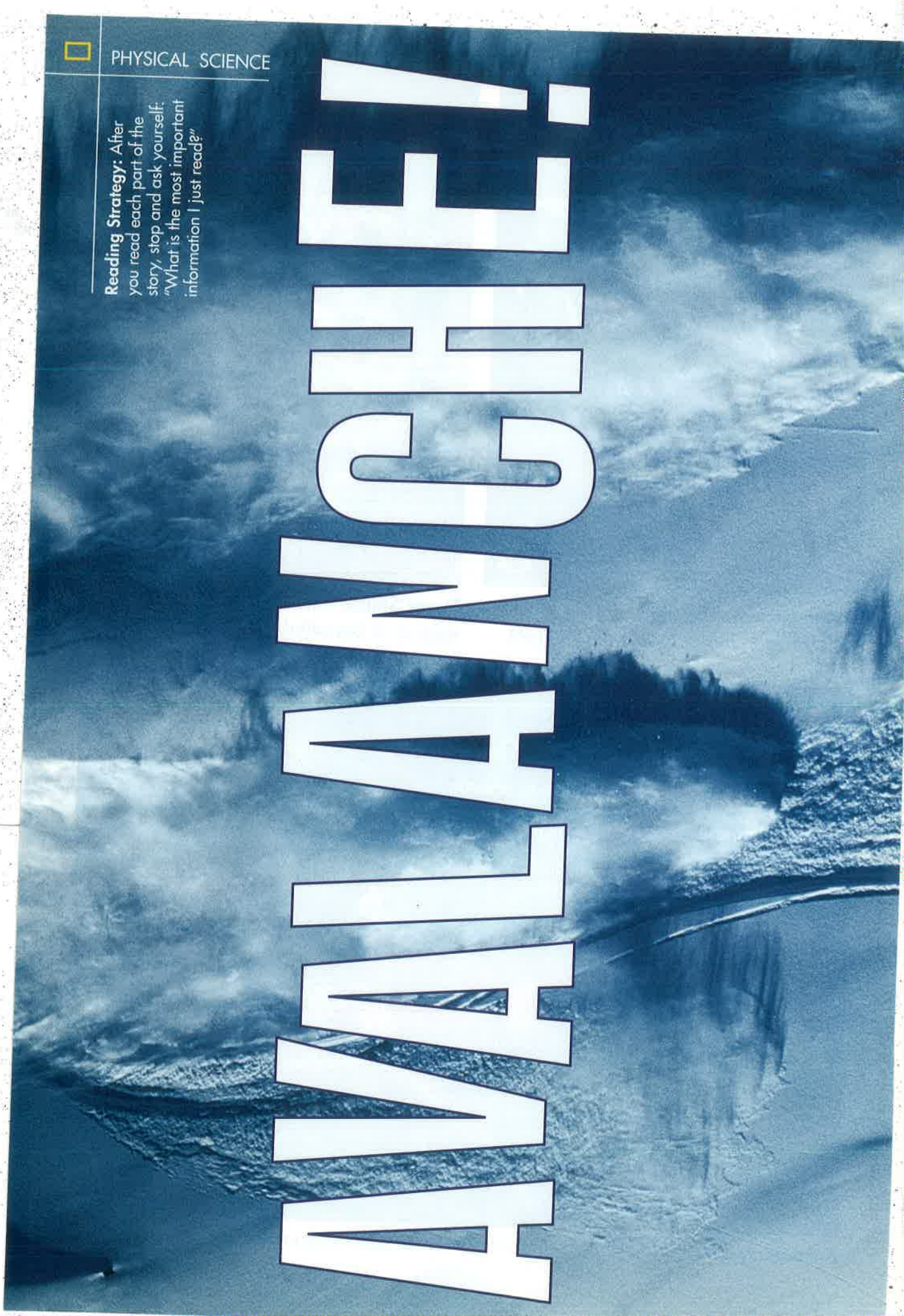
Swimming Slug. This Spanish dancer can swim short distances.

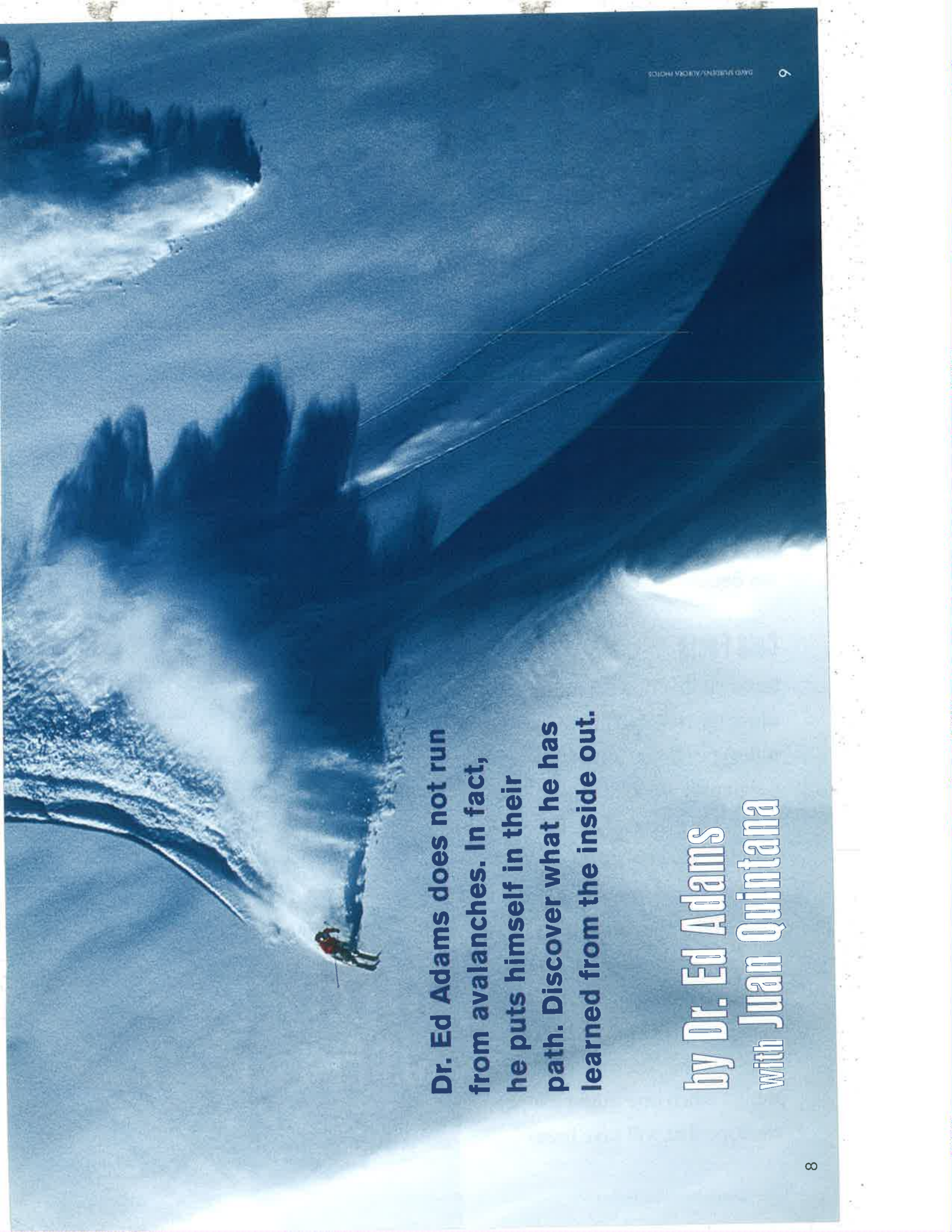


PHYSICAL SCIENCE

Reading Strategy: After you read each part of the story, stop and ask yourself: "What is the most important information I just read?"

AWALANGCHI!





Dr. Ed Adams does not run from avalanches. In fact, he puts himself in their path. Discover what he has learned from the inside out.

**by Dr. Ed Adams
with Juan Quintana**

It's really cold. I'm sitting in a shed on a snowy mountainside. My team checks our computers one last time. We send the signal, "All set to go."

Uphill, our teammates set off an explosion. *BANG!* The explosion sends tons of snow down the mountain. The sliding snow hits our shed. It feels like a freight train. Good thing the shed is bolted to a boulder!

Why am I here? I am a snow scientist. My team and I study **avalanches**. Those are masses of snow rushing downhill. To learn more, we decided to bury ourselves in one!

Cold Facts

Snow sliding down a mountain can move up 100–130 kilometers (60–80 miles) per hour. Some avalanches weigh over 100,000 tons of snow. That's like a herd of 20,000 elephants speeding downhill!

Avalanches are strong—and dangerous. They snap trees in half. They rip up mountains. They kill people and destroy buildings. We want to learn exactly what causes an avalanche. Then we can better predict when one might happen. We hope that will save lives.

STEEP SLOPES

For an avalanche to happen, a mountain slope needs to be at least 25°.





Adding Up. Winter storms dump fresh layers of snow on the snowpack.

© YURI NIKITIN/ALAMY

Triggering Trouble. A skier, snowmobile, or even a falling clump of snow can start an avalanche.

Slides and Slabs

It takes three things to start an avalanche. It takes a steep slope and weak snow. Then it takes a trigger. That's what starts the snow moving.

There are two main types of avalanches: loose snow and slabs. A loose slide is powdery snow tumbling down a slope. It picks up more and more snow as it heads downhill.

A slab is often more dangerous. During the winter, layers of snow add up. They are called the **snowpack**. Over time, sun, wind, and rain make some layers stronger. Other layers get weaker. That can mean trouble.

Think of a sheet of glass (the strong layer). Put it on top of some marbles (the weak layer). One little nudge (the trigger) gets the marbles rolling. The glass will slide right off. That's what happens in a slab avalanche. A weak layer of snow gives out. This sends masses of snow down the mountain.

© TATIANA MAKOTRA/SHUTTERSTOCK (BACKGROUND)



KELLY GORHAM

Snow Study. Adams (right) and Pat Staron check the snow's temperature.

Getting to Know Snow

I need to know how strong or weak layers in a snowpack are. Then I can try to predict a slide. It's easy to see the top layer. But it's hard to see layers below. I dig pits to look at the lower layers. I also listen for the *whumpf* of collapsing snow. That tells me there are weak layers under the surface.

My team uses high-tech tools, too. We put sensors outside our avalanche shed. These sensors test for depth, speed, temperature, and direction. This helps us figure out where the **runout zone** will be. That's where an avalanche dumps snow when it stops. It's important not to build in this area.

Recently, I moved some of my studies inside. I have a special lab. The lab can get as cold as -40°C (-40°F)! I do experiments there. Fans and heat lamps help me study how wind and sun can change layers of snow.

Prediction Program

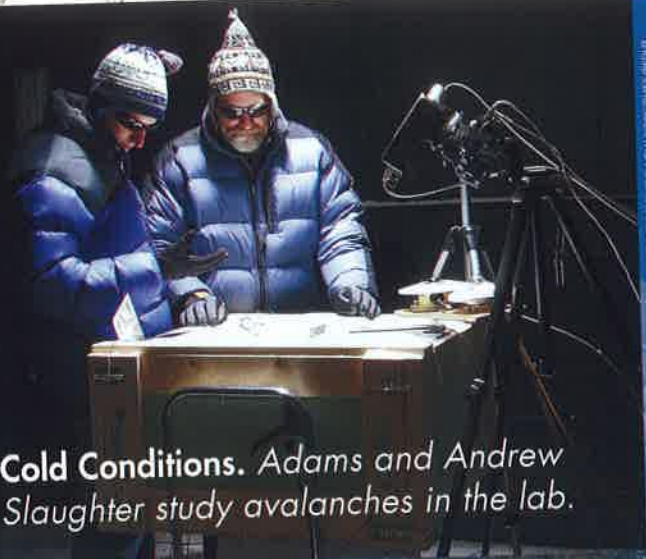
My team and I are using what we learn to make a computer program. It will help predict avalanche danger. First, we put information into a computer. We enter the ways snow changes in different types of weather.

Next, we enter maps of an area. The maps show everything, even rocks and trees. Finally, we enter the day's weather. The computer compares all these things. Then it tells us what is happening to the snow. We can figure out how strong or weak the snowpack is and warn people of any danger.

Snowed Under

The best way to stay safe is to avoid an avalanche! If you like winter sports, take an avalanche safety course. Learn how to travel safely in the mountains. Learn the warning signs for an avalanche.

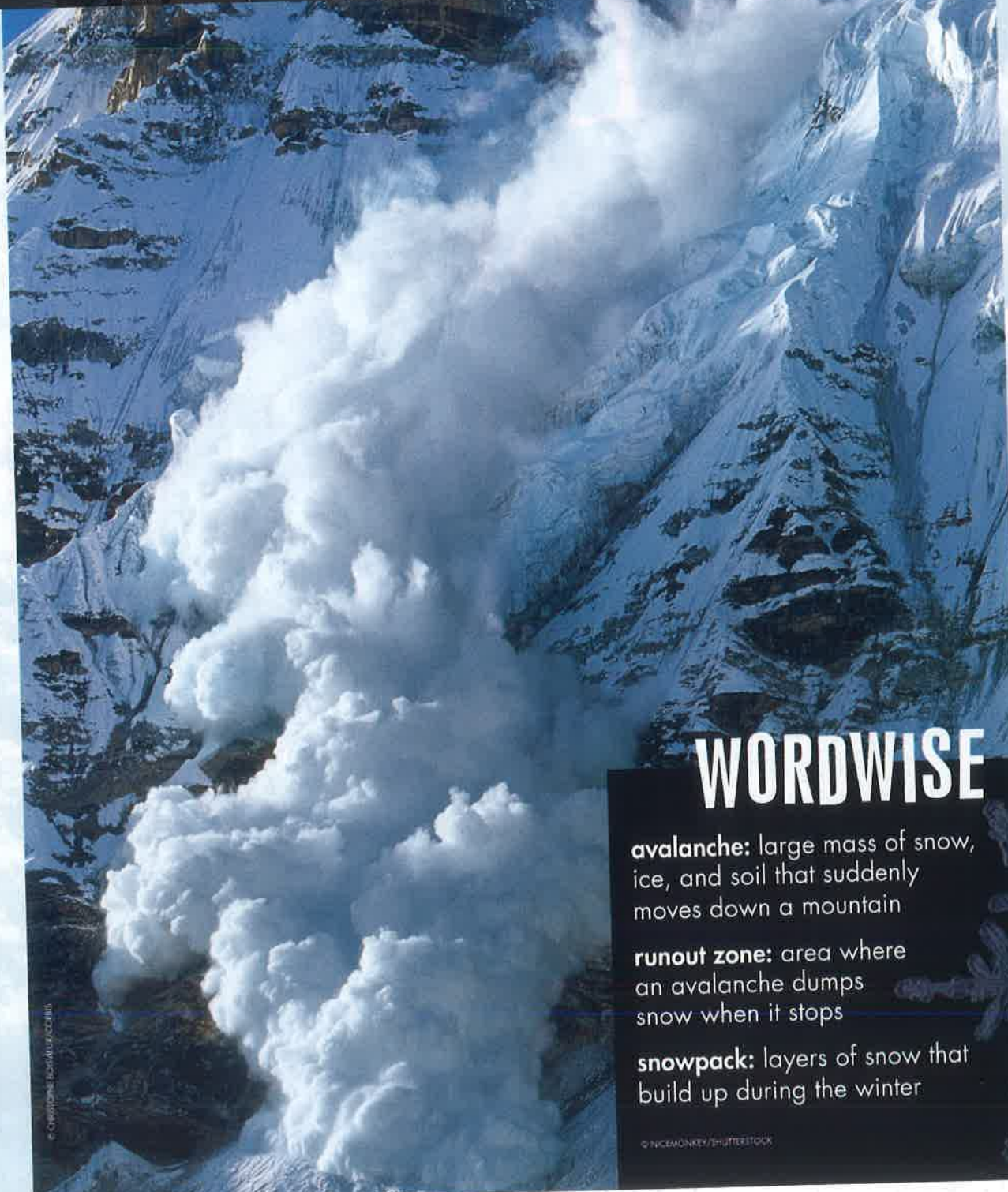
I have learned to respect the power of nature. This protects me. It lets me enjoy winter in the mountains. I know I won't get snowed under—except when I want to, of course.



Cold Conditions. Adams and Andrew Slaughter study avalanches in the lab.

JANE CORCORAN FOR THE NEW YORK TIMES MAGAZINE

Danger Alert. Computer programs may help predict an avalanche like this one.



WORDWISE

avalanche: large mass of snow, ice, and soil that suddenly moves down a mountain

runout zone: area where an avalanche dumps snow when it stops

snowpack: layers of snow that build up during the winter

© OWENSONE BARNHART/ISTOCK

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WAYNE NICHOLAS, COURTESY OF RIA NICHOLAS

The Secret Life of Plants

By Barbara H. Seeber

Plants have a big problem. They are stuck in the ground. They can't run from enemies or search for food, water, or mates. So how do they survive?



MICHAEL DUBHAM/ANDREW J. PICTURES/
NATIONAL GEOGRAPHIC

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Reading Strategy: Preview this story before you start reading. Decide what you want to learn. Then read with your purpose in mind.



Bug Soup

Like you, plants need food and water. Most use sunlight to make their own food. They use their roots to get water. Yet some plants have very odd ways of getting what they need.

The cobra lily is one. It grows in marshes and bogs. These swampy places don't have enough **nutrients**. So the lilies eat bugs. That's right! They eat bugs to get the nutrients.

The cobra lily has two "fangs."

They make sticky nectar to attract bugs. At the top of the plant's leaf is a "hood." Bugs crawl into the "hood" to get the nectar. They slip down the tube and land in a pool of liquid.

Bacteria in the liquid turn the bugs to mush. This makes a soupy meal for the lily. Yum!

Hooded Hunter. *Cobra lilies use their "hoods" to catch insect meals.*



Got Water?

In Australia, the hottest part of the summer is in December. That's when the Christmas tree blooms. At this time the land is very hot and dry. The tree can't always get enough water. So it has to steal it!

To do this, the tree grows suction cups. The little cups clamp onto the roots of nearby plants. Then the cups gulp water from the plants. *Ahhhh!*

Staying Alive

Some plants have a different problem. Things try to eat them! The plants have a solution for that. The thorns on a rosebush keep plant-eaters away.

The passionflower vine has a tricky way to keep from being eaten. Butterflies lay eggs on the vines. When the caterpillars hatch, they eat the vine's leaves. So the vine grows little yellow bumps. Butterflies think the leaf is crowded with "eggs." So they fly on by to find another spot!

In the African desert, animals eat plants to get water. So the stone plant hides by looking just like hard, dry rocks.



Survival Strategies

A sensitive plant has a super strategy. When a bug touches the plant, it folds up. The plant winds its leaflets tightly to its stem. The insect is left with only twigs to munch. Not a great meal.

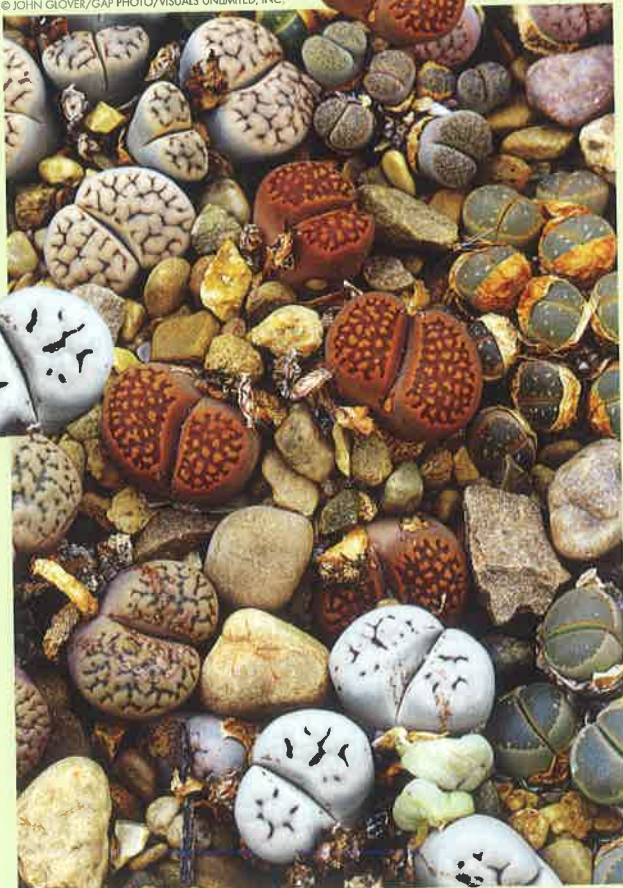
Caterpillars that eat cotton or corn plants run into big trouble, too. When they start to chew, the plants let out an odor. The smell attracts wasps. The wasps lay eggs on the caterpillars. In a few days, the eggs hatch—and eat the caterpillars!



MICHAEL AND PATRICIA FOGDEN/WINDEN PICTURES/NATIONAL GEOGRAPHIC STOCK

Tricky Tree. Suckers on an Australian Christmas tree steal water from plants.

© JOHN GLOVER/GAP PHOTO/VISUALS UNLIMITED, INC.



Living Rocks. Can you spot the stone plants in this picture?



DARLINE A. MURAWSKI/PETER ARNOID INC.

Fabulous Faker. Yellow spots on this vine look like butterfly eggs.