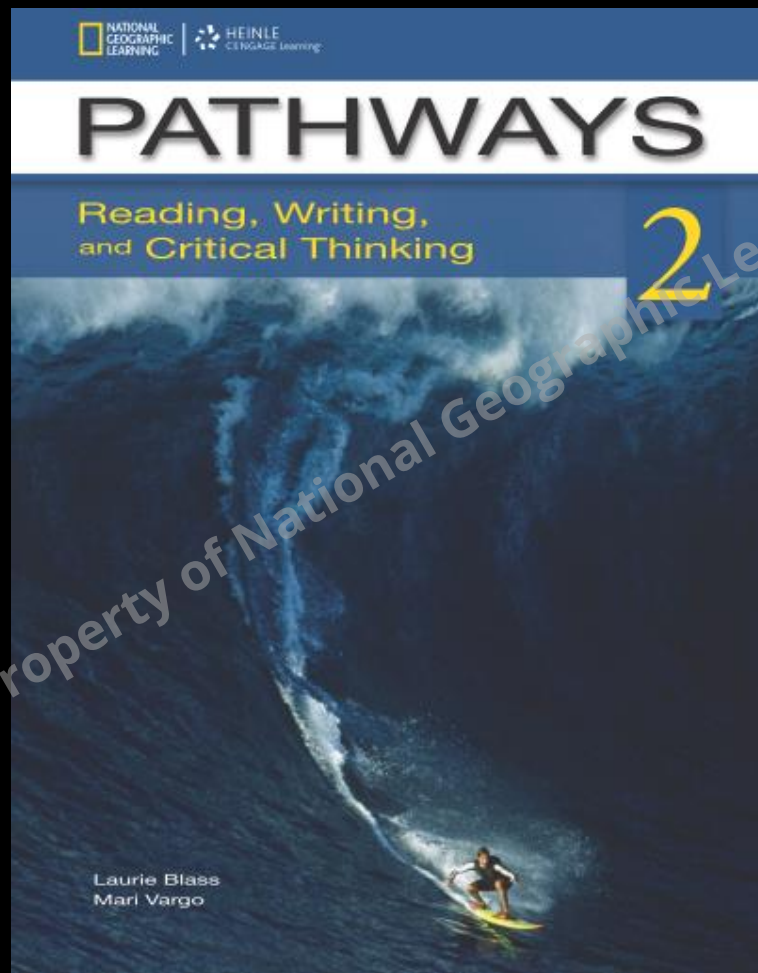


*From Critical Thinking to
Thinking-based Learning*

Pathways Reading, Writing and Critical Thinking Level 2, Unit 9



Beijing, China
June, 2017
Mike McLoghlin
Senior ELT Consultant



FORM **FUNCTION**

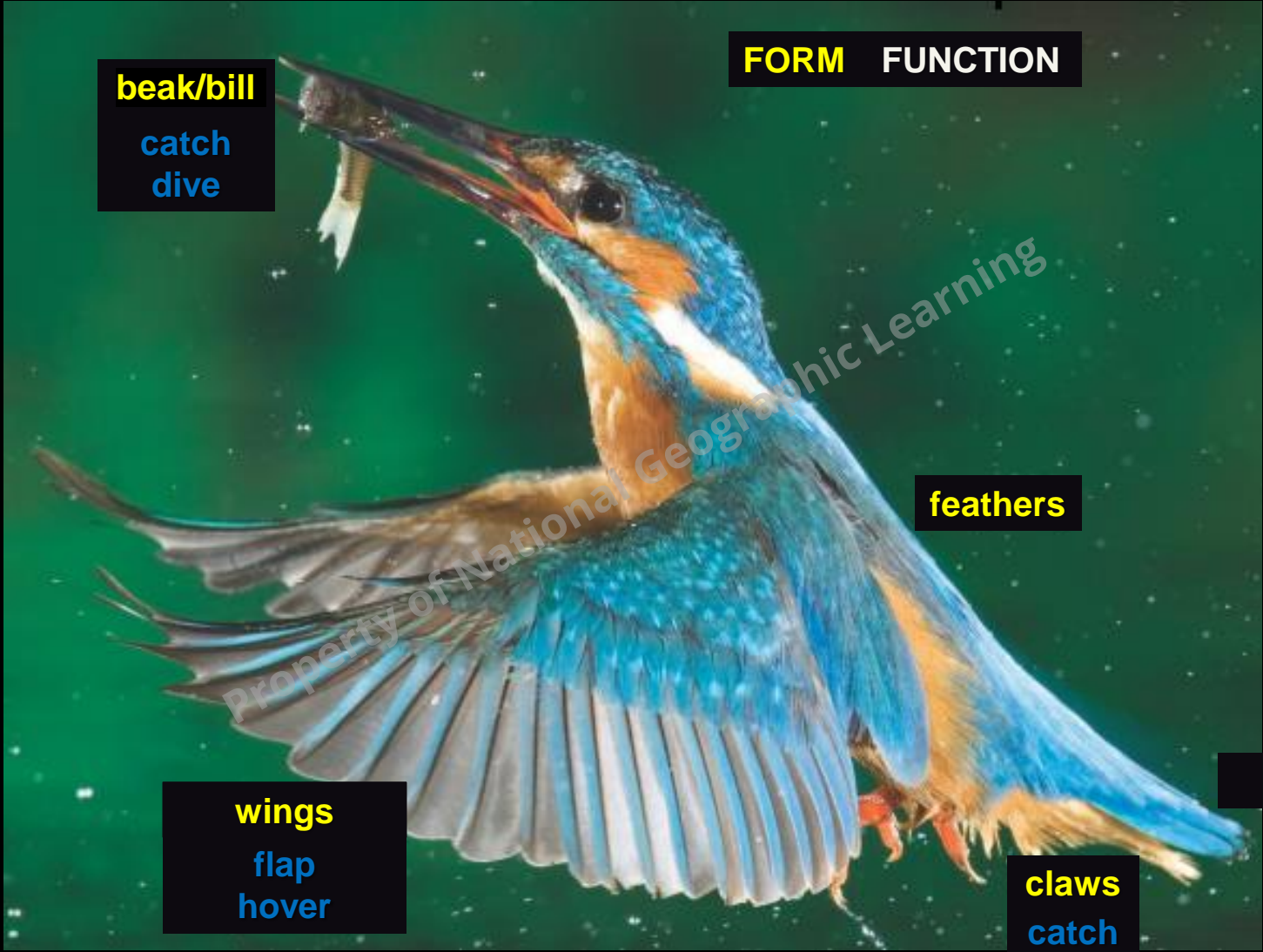
beak/bill
catch
dive

feathers

wings
flap
hover

tail

claws
catch



Do you know these words? What do they mean?
Discuss with your partner

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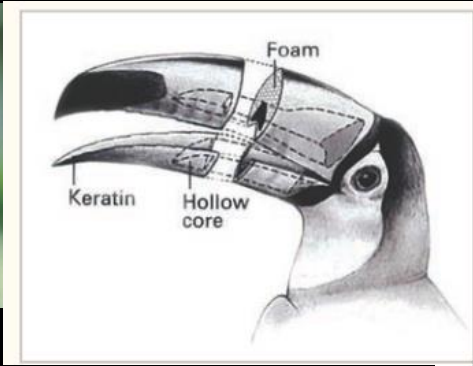


What do you think the article will be about?

Design by Nature

ALL LIVING organisms are **uniquely** adapted to the environment in which they live. Scientists study their designs to get ideas for products and technologies for humans. This **process** is called biomimetics. Here are three examples—in the air, on land, and in the water.

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g in water or air.

Animal Part	Purpose	Product or Technology
toucan <u>bill</u>		
beetle _____		
shark _____		bathing suits

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Animal Part	Purpose	Product or Technology
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Toucan Bills and Car Safety

B Toucan bills are so enormous that it's surprising the birds don't fall on their faces. One species of toucan, the toco toucan, has an orange-yellow bill six to nine inches (15–23 centimeters) long. It's about a third of the bird's entire length. Biologists aren't sure why toucans have such large, colorful bills. Charles Darwin¹ theorized that they attracted mates. Others suggest the bills are used for cutting open fruit, for fighting, or for warning predators to stay away.

C One thing scientists are certain of is that the toucan's beak is well designed to be both strong and light. The surface is made of keratin, the same material in human fingernails and hair. But the outer layer isn't a **solid** structure. It's actually made of many layers of tiny **overlapping** pieces of keratin. The inside of the bill has a foam-like structure—a network of tiny holes held together by light, thin pieces of bone. This design makes the bill hard but very light.

D Marc André Meyers is an engineering professor at the University of California, San Diego. He thinks the automotive and aviation **industries** can use the design of the toucan bill to make cars and planes safer. "Panels that **mimic** toucan bills may offer better protection to motorists **involved** in crashes," Meyers says.

Animal Part	<u>Purpose</u>	Product or Technology
toucan <u>bill</u>	<ul style="list-style-type: none">• Fighting• Warning predators to stay away• Cutting open fruit	Car panels to protect people in crashes
beetle <u>shell</u>		
shark <u>scales</u>		bathing suits

Animal Part	Purpose	Product or Technology
toucan <u>bill</u>	<ul style="list-style-type: none"> Fighting Warning predators to stay away Cutting open fruit 	Car panels to protect people in crashes
beetle <u>shell</u>	<ul style="list-style-type: none"> Collect water from desert air 	<ul style="list-style-type: none"> Inexpensive tent coverings Roofs that can collect water Farms in dry part of the world
shark <u>scales</u>	<ul style="list-style-type: none"> Protect shark Help shark to swim more quickly 	bathing suits

Critical Thinking: Comparison/Analysis

Animal Part	Purpose	Product or Technology
toucan <u>bill</u>	<ul style="list-style-type: none">• Fighting• Warning predators to stay away• Cutting open fruit	Car panels to protect people in crashes
beetle <u>shell</u>	<ul style="list-style-type: none">• Collect water from desert air	<ul style="list-style-type: none">• Inexpensive tent coverings• Roofs that can collect water• Farms in dry parts of the world
shark <u>scales</u>	<ul style="list-style-type: none">• Protect shark• Help shark to swim more quickly	bathing suits



D | Critical Thinking: Applying. Which of the following are examples of biomimetics? Which are not? Discuss your answers with a partner.

1. using bird feathers in a jacket to stay warm in cold weather
2. inventing a material for making boats that has the same structure as a toucan bill
3. making a rain hat that mimics the structure of the *Stenocara* beetle's shell
4. attaching sharkskin to the bottom of a boat to make it go faster in the water

Critical Thinking: Evaluation

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F | **Critical Thinking: Synthesizing.** Look again at the first line of the reading: “All living organisms are uniquely adapted to the environment in which they live.” Discuss this question in small groups: *How is each organism described in this unit uniquely adapted to its environment?*

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贾涵钧 (Billy) hanjun.jia@cengage.com
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A scenic view of a river at dusk. The sky is a deep purple and blue, with silhouettes of jagged mountains in the background. In the foreground, two people are in traditional wooden boats on the water. The boats are illuminated from within, and their lights reflect on the calm surface of the river. The overall mood is peaceful and serene.

Thank you for being my students today!!

GOOD LUCK!

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