TPO37L4 Endotherms And Ectotherms Narrator: Listen to part of a lecture in a biology class.

Professor: So, to review, who remembers how animals are classified in terms of body temperature? Mike?

Student: Um, endotherms and ectotherms?

Professor: Right! All animals are considered either endotherms or ectotherms. Therm-that means heat, and the main thing that distinguishes endotherms from ectotherms is the source of body heat.

So an endotherm, endo- meaning internal, an endotherm's body heat mainly comes from inside its body. It can generate its own heat internally with its metabolism. And an ectotherm, ecto- meaning external, an ectotherm gets its body heat mainly from outside its own body, meaning from its environment, mostly from the sun's radiation. So we've got endotherms. Mammals and birds are the classes that fall under this category. And ectotherms, that's pretty much everything else, including reptiles, amphibians, insects.

Now, body temperature is important. And if an animal’s environment gets very hot or very cold, something needs to happen in order for the animal to maintain its body temperature within its normal range. In endotherms, this is mostly physiological. The body changes its rate of heat production.

Okay, well, humans are endotherms. What does your body automatically do when it gets really cold?

Student: Shiver?

Professor: Right, shivering. In fact, any muscle movement increases metabolism, the process that produces heat and keeps your body temperature up when your surroundings get cold. And then there's what's known as brown fat, like other kinds of fat, it stores triiodothyronine, but brown fat is unique because it chemically produces lots of heat even without muscle movement. That's especially beneficial for small mammals in colder climates. And when an animal gets too hot, well, have you ever seen a dog cooling off by taking short, quick breaths? And humans, we sweat, of course, perspire, which also gets rid of body heat. These are automatic, physiological responses too. Yes, Sally?

Student: So, in endotherms it's really not about behavior, about doing things.

Professor: Well, a human, you know, might put on a winter coat or jump in a swimming pool, or elephants, elephants might splash themselves with cold water when it's warm out, but for the most part, no. It's not what we endotherms do that keeps our temperatures within range, unlike ectotherms.

Student: Well, what about ectotherms, like frogs? They must have metabolism too.

Professor: Sure they do. It's just that metabolism in ectotherms is so much lower. I mean, the metabolic rate of an endotherm, say, a mouse, is at least six or seven times that of an ectotherm of a similar size like a frog or a lizard. An ectotherm doesn't generate nearly as much heat internally. So its body temperature will tend to equalize with the temperature of its surroundings. And that's where behavior comes in. Imagine a lizard, okay, living in the desert.

Now, a desert gets very cold at night and very hot during the day. So what does the lizard do to maintain its body temperature? Well, on a cold morning, it can warm itself by going to a sunny spot and lying in the sun, and later if it gets too hot, it can seek out a cool place in the shade. It's by means of such behavior that an ectotherm like this lizard regulates its temperature. But you put that same lizard in a temperature controlled chamber and gradually drop the temperature, say, 20 degrees, and here of course, the lizard can't go off to lie in the sun. So what happens?

Student: Well, the lizard's body temperature drops too.

Professor: Right, and this really slows down its metabolism, which depends on temperature. Even that 20 degrees drop in body temperature though, the lizard can survive that no problem, and come out just fine when it warms up again. Ectotherms can do that.

Student: But an ectotherm probably wouldn't survive in a place where the temperatures got too low, right?

Professor: Ever heard a frog being chased by a polar bear?

Student: No.

Professor: Well, there you are. Now a mouse in the same situation, in the same temperature chamber, is just the opposite of the lizard. When the temperature goes down, the mouse's metabolism goes up. Like any endotherm, it starts producing more heat to keep its body temperature stable, same as it would do outside in a field.

TPO31L3 Coral Reefs & CoT starfish Listen to part of a lecture in a Marine Biology class.

Professor: We’ve been talking about the decline of coral reefs in tropical areas all over the world…um… how natural and man-made stresses are causing them to degrade, and in some cases, to die.

So now let’s focus on a specific example of a natural predator that can cause a lot of damage to coral reefs—the Crown of Thorns, or CoT starfish. The Cot starfish is found on coral reefs in the tropical Pacific Ocean and it eats coral. Now, in small numbers, the starfish don’t affect coral reefs dramatically. But periodically, starfish population explodes. And when that happens, the reefs can become badly damaged or even destroyed, something we are trying very hard to prevent. For example, during the 1960s, there was an outbreak of CoT starfish in the Great Barrier Reef, off the east coast of Australia. Luckily, the CoT starfish population gradually declined on its own and the reefs recovered.

But we were left wondering – what cause the population to increase so suddenly? Well, over the years, we’ve come up with a few hypotheses. All still hotly debated.

One hypothesis is that it’s a natural phenomenon, that the starfish naturally undergo population fluctuations following particularly good spawning years.

There are also several hypotheses that suggest some sort of human activities are partly responsible, like fishing. There are fish and snails that eat starfish, particularly the giant triton snail, which is the main predator of the starfish. These fish and snails have themselves experienced a decline in population because of overfishing by humans. So with a decline in starfish predators, the starfish population can increase.

Another hypothesized human-related cause is fertilizer runoff. People use fertilizer for their crops and plants and a lot of it eventually makes its way from land into the seas. It’s fertilizer, so it has a lot of nutrients. These nutrients have an effect on the starfish, because they cause an increase in the growth of phytoplankton. Phytoplankton are microscopic plants that grow in the ocean. Larval CoT starfish eat phytoplankton in their first month of life, so more fertilizer in the ocean means more phytoplankton, which means more starfish, bad for the reefs.

Now, the final hypothesis has to do with storm events. If some reefs are destroyed by storms, starfish populations that inhabited those reefs would have to condense and concentrate on the reefs that are left. So this can cause a kind of mass feeding frenzy.

So we have ideas, but no real answer. And because we aren’t sure of the causes for starfish population increases, it’s difficult to prevent them. I mean, some progress has been made. For example, new survey techniques have enabled us to detect population increases when the starfish are quite young, so we can be ready for them. But meaningful progress requires much better evidence about the cause.

On the bright side, in all the research being done on causes, we have discovered something related to how starfish populations might affect coral reef diversity. We think that when reefs are damaged, after a few years, the fastest-growing corals repopulate the areas. And these fast-growing species can grow over the slower-growing species of coral, denying them light and preventing them from recovery. However, the faster-growing species are the preferred food of the CoT starfish. So when an outbreak of CoT starfish occurs, they thin out the fast-growing coral and may give the slower ones a chance to reestablish. So without the outbreak, the diversity of coral would be reduced.