Glass act: Scientists reveal secrets of frog transparency

December 25 2022, by Christina Larson

This photo provided by researchers in December 2022 shows a glass frog, strict leaf dwelling frogs, that sleep, forage, fight, mate, and provide (male) parental care on leaves over tropical streams. Some frogs found in South and Central America have the rare ability to turn on and off their nearly transparent appearance, researchers report Thursday, Dec. 22, 2022, in the journal Science. Credit: Jesse Delia/AMNH via AP

Now you see them, now you don't.

Some frogs found in South and Central America have the rare ability to turn on and off their nearly transparent appearance, researchers report Thursday in the journal Science.

During the day, these nocturnal frogs sleep by hanging underneath tree leaves. Their delicate, greenish transparent forms don't cast shadows, rendering them almost invisible to birds and other predators passing overhead or underneath.

But when northern glass frogs wake up and hop around in search of insects and mates, they take on an opaque reddish-brown color.

"When they're transparent, it's for their safety," said Junjie Yao, a Duke University biomedical engineer and study co-author. When they're awake, they can actively evade predators, but when they're sleeping and most vulnerable, "they have adapted to remain hidden."

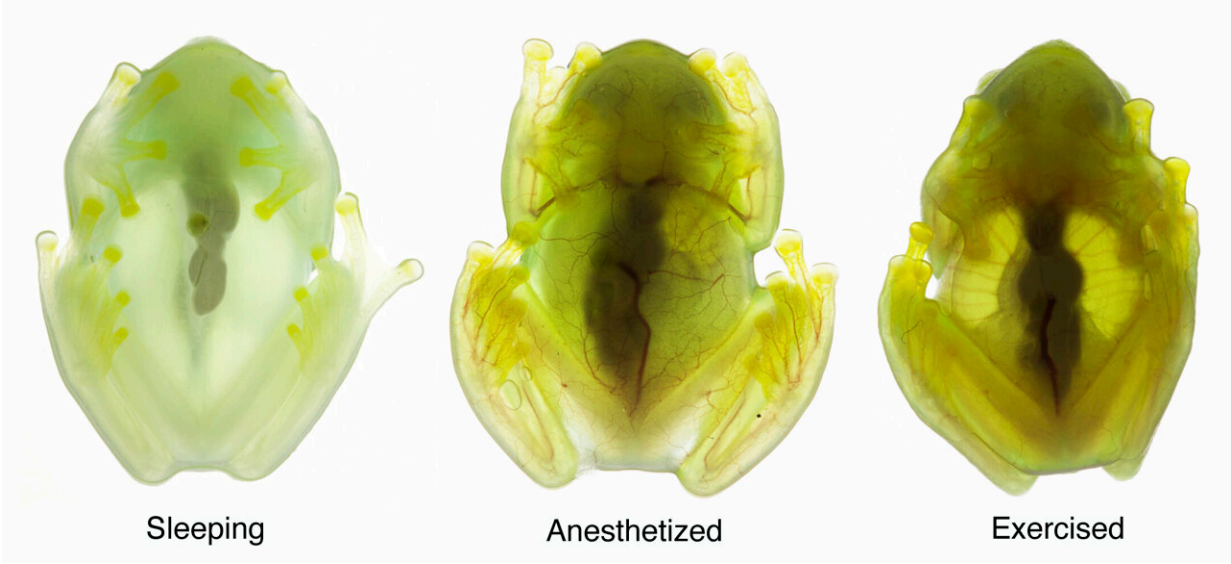
Using light and ultrasound imaging technology, the researchers discovered the secret: While asleep, the frogs concentrate, or "hide," nearly 90% of their red blood cells in their liver.

Because they have transparent skin and other tissues, it's the blood

circulating through their bodies that would otherwise give them away. The frogs also shrink and pack together most of their internal organs, Yao said.

The research "beautifully explains" how "glass frogs conceal blood in the liver to maintain transparency," said Juan Manuel Guayasamin, a frog biologist at University San Francisco of Quito, Ecuador, who was not involved in the study.

Exactly how they do this, and why it doesn't kill them, remains a mystery. For most animals, having very little blood circulating oxygen for several hours would be deadly. And concentrating blood so tightly would result in fatal clotting. But somehow, the frogs survive.



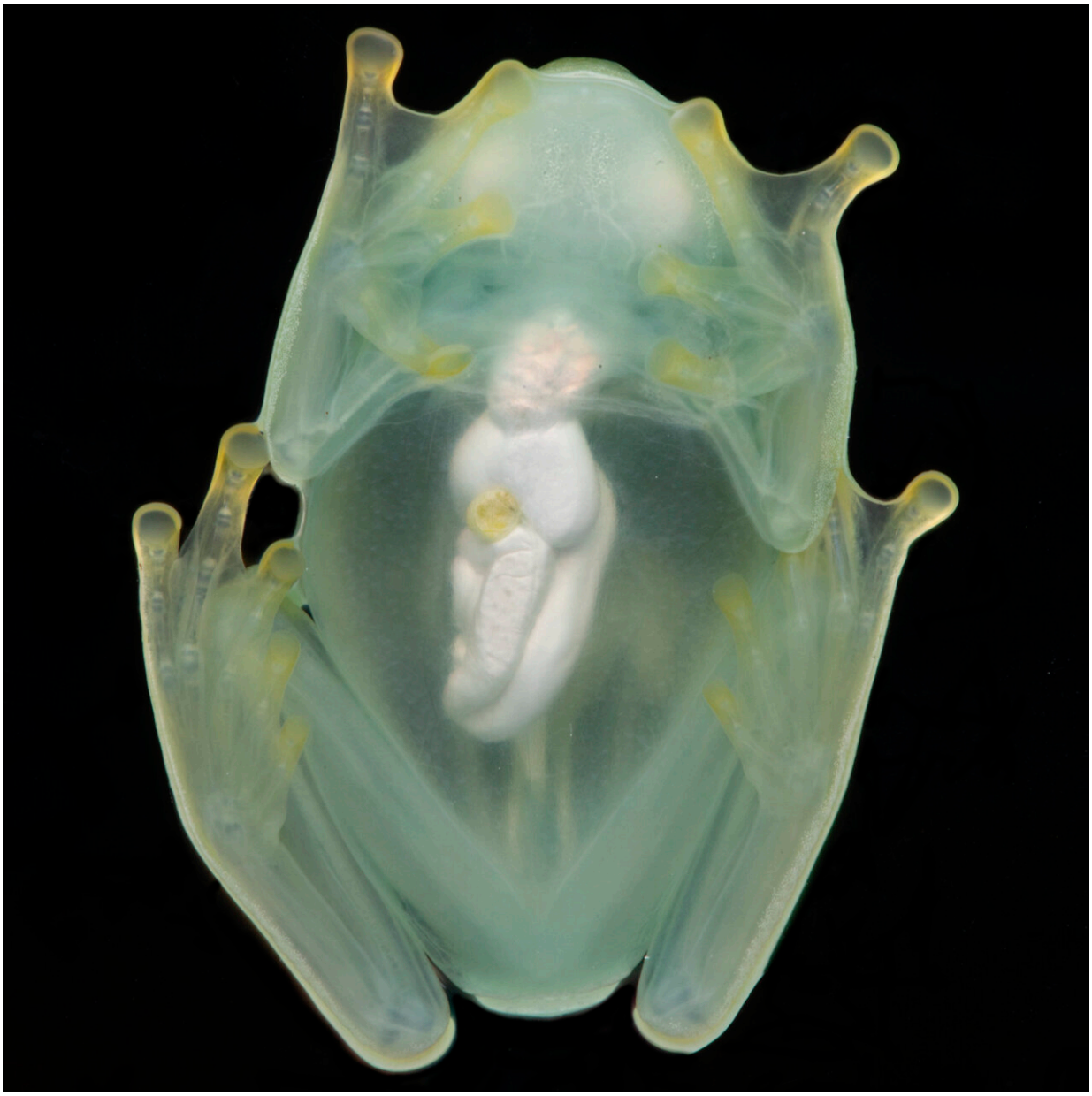
This combination of photos provided by researchers in December 2022 shows the same glass frog photographed during sleep, under anesthesia, and while active (in transmitted light), showing the difference in red blood cells within the circulatory system. Some frogs found in South and Central America have the rare ability to turn on and off their nearly transparent appearance, researchers report Thursday, Dec. 22, 2022, in the journal Science. Credit: Jesse

Delia/AMNH via AP

Further research on the species could provide useful clues for the development of anti-blood clotting medications, said Carlos Taboada, a Duke University biologist and study co-author.

Only a few animals, mostly ocean dwellers, are naturally transparent, said Oxford University biologist Richard White, who was not involved in the study. "Transparency is super rare in nature, and in land animals, it's essentially unheard of outside of the glass frog," White said.

This photo provided by researchers in December 2022 shows a group of glass frogs sleeping together upside down on a leaf, showing their leaf camouflage in transmitted (downwelling) light. Some frogs found in South and Central America have the rare ability to turn on and off their nearly transparent appearance, researchers report Thursday, Dec. 22, 2022, in the journal Science. Credit: Jesse Delia/AMNH via AP



This photo provided by researchers in December 2022 shows a male glass frog photographed from below using a flash, showing its transparency. Scientists measured muscle and ventral skin, finding that these tissues transmit over 90% of visible light and are yet perfectly functional. Some frogs found in South and Central America have the rare ability to turn on and off their nearly transparent appearance, researchers report Thursday, Dec. 22, 2022, in the journal Science. Credit: Jesse Delia/AMNH via AP

This photo provided by researchers in December 2022 shows glass frogs, strict leaf dwelling frogs, that sleep, forage, fight, mate, and provide (male) parental care on leaves over tropical streams. Some frogs found in South and Central America have the rare ability to turn on and off their nearly transparent appearance, researchers report Thursday, Dec. 22, 2022, in the journal Science. Credit: Jesse Delia/AMNH via AP

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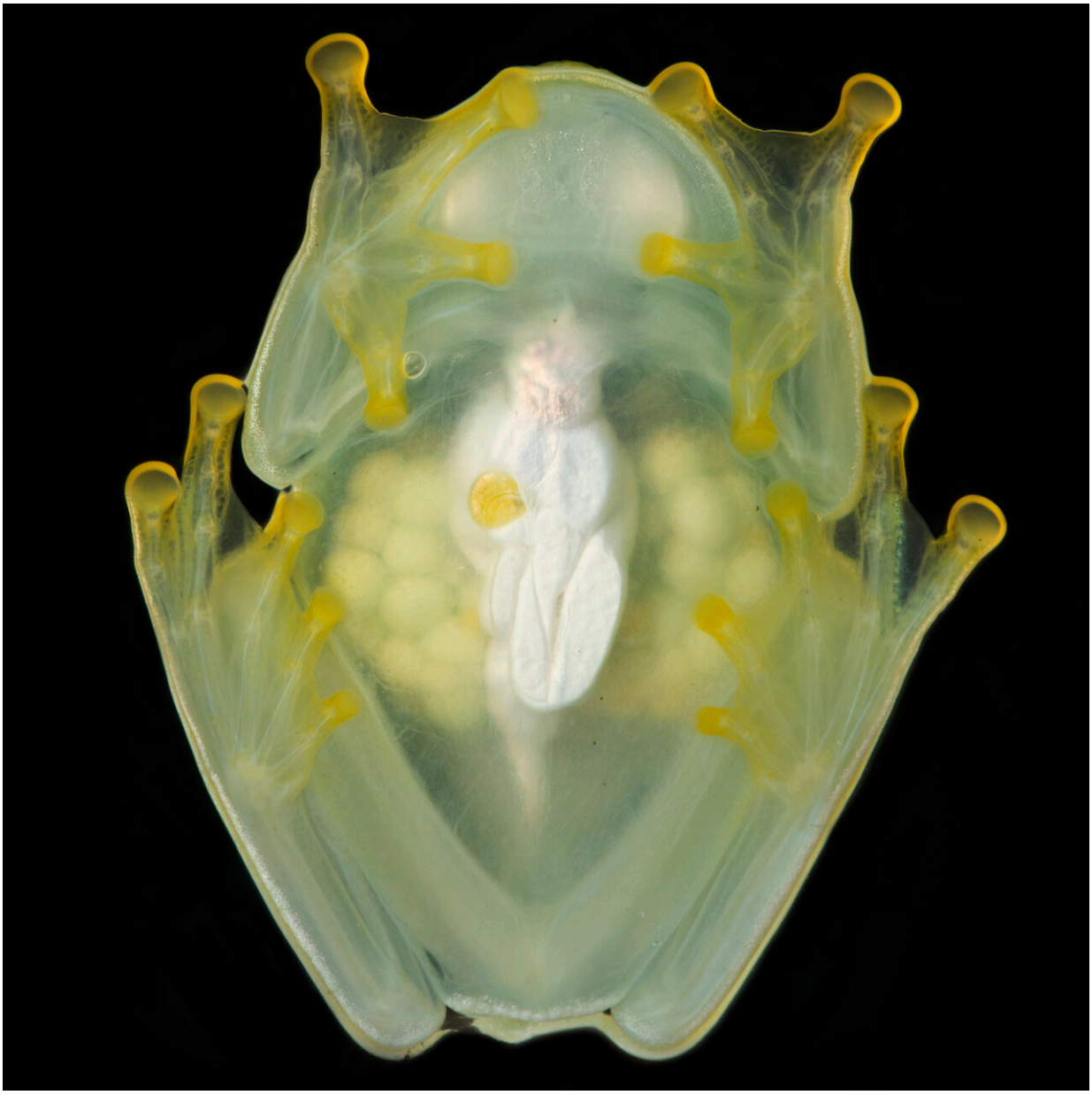
This photo provided by researchers in December 2022 shows a sleeping glass frog photographed with a flash from its back side, showing its leaf-green coloration in reflected light. Some frogs found in South and Central America have the rare ability to turn on and off their nearly transparent appearance, researchers report Thursday, Dec. 22, 2022, in the journal Science. Credit: Jesse Delia/AMNH via AP



This photo provided by researchers in December 2022 shows a female glass frog with eggs in her transparent ovaries, photographed from below using a flash. Some frogs found in South and Central America have the rare ability to turn on and off their nearly transparent appearance, researchers report Thursday, Dec. 22, 2022, in the journal Science. Credit: Jesse Delia/AMNH via AP

Those that are transparent include some fish, shrimp, jellyfish, worms and insects—none of which move large quantities of red blood through their bodies. The trick of hiding blood while sleeping appears to be unique to the frogs.

"It's just this really amazing, dynamic form of camouflage," said White.