

For Ministers, Religious Educators and Leaders



September, 2009 A Story for All Ages

Autumn brings change and new beginnings, and the capacity for adaptation is one of nature's miracles. Share this story about Central America's red-eyed tree frog to awaken wonder and remind all ages that all beings are equipped to thrive in new situations. Find a longer version of this story, reprinted from an article in the *Boston Globe*, in the Tapestry of Faith adult leadership program, Harvest the Power.

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Red-Eyed Tree Frogs Adapt to Survive

Adaptation, responding to ambient stress or danger, is a key survival skill for many biological species. Recent research by Boston University scientist Karen Warkentin has revealed that tree frogs, even in their embryo stage, show an adaptive response to cues about environmental conditions. Working in frog ponds in Central America's tropical rainforests, she and her colleagues are expanding our understanding of how these creatures develop in response to their environment.

Red-eyed tree frogs lay their eggs in clusters on leaves that overhang ponds. Those eggs are normally ready to hatch in about six to eight days. When the eggs hatch, the tadpoles fall into the water below. Dr. Warkentin has found that the embryos can somehow detect danger in their environment. By accelerating or delaying their hatching, embryos increase their chance of survival.

Generally, delaying hatching as long as possible will increase the chance of tree frog survival. The larger the embryo grows before hatching, the less likely the tadpole will be consumed by fish or fresh water shrimp. A few extra days of growth make the tadpoles too big for predators to easily consume. However, a delay in hatching causes the embryo to risk asphyxiation as the oxygen supply in the egg runs low. Somehow, the embryos, without any capacity for muscle movement, manage to orient themselves so their gills are positioned in the area of the egg where there is the most oxygen, often near the surface where the egg is exposed to the air. Sometimes, though, there is greater risk than asphyxiation in delaying the time of hatching. Many tree-frog eggs are consumed by snakes. When a snake attacks a cluster of eggs, the embryos appear to detect vibrations from the snake and begin at once to hatch early and fall into the water, taking their chances with the shrimp and other predators below. Dr. Warkentin has shown that embryos respond to approaching snake vibrations and hatch early, but seem unaffected by other kinds of vibrations, such as those from weather

systems. She has intrigued the scientific world by demonstrating that three frog embryos consistently adapt their response in such a way as to maximize their chance of survival.

Red-eyed tree frogs are not the only adaptive amphibian. Boston University doctoral candidate Justin Touchon has found that hourglass tree frogs lay their eggs either in land or in the water, apparently choosing a spot for its optimal incubation conditions. Even when moved to an unfamiliar habitat, an hourglass tree frog will pay attention to the temperature, the level of moisture in the air and the presence or absence of shade before laying her eggs.

These biologists and others have found complexity at every turn in their work with tree frogs, suggesting that these biological creatures are surprisingly well equipped to deal with the adaptive challenges that face them in their quest for survival.

Sometimes, the moment you meet someone, you know they will be a very important friend in your life. Other times, friendships start slowly. You might not know how important the friendship is for many years.

Connecting with Our Lives

- Encourage congregants of all ages to identify the changes and new beginnings they face this autumn, and reflect on the adaptations they will need to make.
- Find out about biodiversity in your local area. What species are common? Are any endangered? What conditions help some species thrive? Why, for other species, is their natural capacity to adapt not enough to protect them?