Doctor Nature

Cures for AIDS and some cancers could be at our fingertips if we did a better job of looking after biodiversity, says Eric Chivian.

We humans are an integral part of nature, and our health depends ultimately on the health of its species and ecosystems. Surely, the extinction crisis could be stopped in its tracks if the world better understood the critical role that biodiversity plays in providing new medicines, clean water and protection from disease?

Over millions of years, species have developed chemicals that protect them against infections and diseases and allow them to capture prey and defend themselves—chemicals that have become some of today's most important pharmaceuticals. With the loss of plant, animal and microbial diversity, we're losing the chance to discover new medicines that could end the suffering of millions of people and save national economies billions of dollars each year.

Amphibians contribute to human medicine in many ways, from chemicals they contain that may lead to new painkillers and drugs to treat high blood pressure, to their roles in biomedical research. They may help us figure out ways to prevent bacteria from developing resistance to antibiotics, a phenomenon causing great alarm among doctors as they struggle to keep one step ahead of their patients' infections. The Waxy Monkey Frog from South America manufactures potent antibiotics in its skin that attack bacteria and fungi, including some that cause infections in people with weakened immune systems, such as those with HIV/AIDS. These compounds have worked for millions of years, without their microbial targets developing effective resistance to them.

Tropical rainforest species have given us quinine, the first major treatment for malaria, quinidine from the Cinchona Tree, used for heart conditions, and cancer-fighting drugs from the Rosy Periwinkle plant, which have revolutionized the treatment of acute childhood leukemia and Hodgkin's Lymphoma. Temperate species have also yielded some of our most useful drugs—the 'wonder drug' aspirin was originally derived from salicin, extracted from the willow tree.

Species also provide medical research models that help us understand human physiology and disease. Consider the polar bear. During its several month hibernation it is largely immobile and doesn't eat, drink, urinate or defecate, yet it does not starve, become dehydrated, lose bone mass or die from the build-up of urinary wastes. If we stop urinating for only a few days, we die. There is no cure for people with end-stage renal disease, but if we understood how bears recycled their urinary wastes into new proteins, we could possibly treat renal failure.

We may be losing new medicines and clues for research before species have been studied for their medical potential, or even before they have been discovered. Considered commercially worthless, the Pacific Yew tree was routinely discarded during logging operations until it was found to contain the compound Taxol, now considered one of the most effective chemotherapeutic agents for ovarian, breast and other cancers. How many species like the Pacific Yew are being lost without our ever knowing whether they contain wonder drugs?

The story of gastric-brooding frogs from the rainforests of Australia provides a tragic example of lost potential. The females of both species of these frogs swallowed their fertilized eggs, which then hatched in their stomachs and developed before being vomited into the outside world as fully-formed tadpoles. In the mother's stomach, the tadpoles secreted a substance that prevented their being digested. New insights about treating gastric ulcers might have been uncovered by studying these frogs, but these studies are no longer possible, as both species are now considered extinct.

Species diversity has been shown to help protect people from Lyme disease, the most common human vector borne disease in the US. The disease is caused by bacteria carried by a tick whose preferred host is the white-footed mouse. Having large numbers and types of vertebrates in Lyme areas 'dilutes' the bacterial population, and makes it less likely for people to become infected. It also means more predators for the mice, keeping their populations low, thereby reducing the risk of human exposure. Forest fragmentation reduces vertebrate diversity, so as people move closer to forest edges and break up forested areas with development, we may see an increase in Lyme cases. This same mechanism of pathogen 'dilution' may apply to other vector-borne diseases such as West Nile virus disease.

To help stem the loss of species, scientists from a range of disciplines, from industrialized and developing countries alike, are working to catalogue the critical links between biodiversity and human health. We hope our efforts will guide policy makers in developing innovative policies, based on sound science, that safeguard biodiversity. We're convinced that once people recognize how much is at stake with their health and lives, and with the health and lives of their children, they will do everything in their power to protect the global environment.

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IUCN is collaborating with the Center for Health and the Global Environment on a book *Sustaining Life: How Human Health Depends on Biodiversity* which will be published in April 2008.