went extinct and the other didn't and then use that [knowledge] in conservation efforts," Miller says. If the research turns up genes associated with survival, scientists can use that information to develop a breeding program for the Tasmanian devil that maximizes the genetic diversity of the population—and increases the frequency of genes that confer immunity. Perhaps the greatest promise of ancient DNA is not raising the dead but preserving the living.

MATERIALS

Chasing Rainbows

From infrared to ultraviolet, a new photovoltaic material responds to the full spectrum of sunlight BY JESSE EMSPAK

Overcast days are the enemy of solar energy. Most photovoltaic cells respond to only a relatively narrow part of the sun's spectrum—and it just happens to be the one that clouds tend to block out. Manufacturers deal with the problem by layering different materials in the cell, but that approach makes them more expensive.

Led by chemist Malcolm Chisholm, a team at Ohio State University took a different tack. They doped a polymer commonly used for semiconductor applications, called oligothiophene, with atoms of the metals molybdenum and tungsten. The result was a substance that generates power in response to light of wavelengths from 300 (ultraviolet) to 1,000 nanometers (the near infrared). In contrast, traditional, silicon-based cells function best starting from 600 (orange) to 900 nanometers (deep red). The polymer can work at such a wide range because it both fluoresces and phosphoresces.

Most solar cell materials just fluoresce: sunlight striking them excites electrons into a higher energy state, and then they drop back down to their ground state and emit light. (Generally, the fluorescence is not noticeable—the wavelength of the emitted light is in the infrared spectrum, or else the light is too feeble to see in the sun; a few solar cell designs reuse the light to boost efficiency.) Some of those electrons become excited enough to break free from the atoms they surround; these electrons can serve as the basis for the electric current.

But the electrons do not stay free for long—only trillionths of a second. They may drop back to the ground state before serving any useful purpose. This is one reason solar cells do not operate with 100 percent efficiency.

The polymer Chisholm and his team developed also phosphoresces like glow-in-the-dark toys. Electrons hold on to their energy longer in phosphorescence than in fluorescence and thus stay free longer, on a scale of microseconds. Although based on their calculations the team expected the material to fluoresce, they only saw the phosphorescence after they tested it.

The doping makes the difference. Both tungsten and molybdenum are metal atoms that have more electrons that are available for conduction than those of the polymer alone. Moreover, the electron configurations of the metals allow for longer-lived free electrons.

The team, which described its results in the October 7 *Proceedings of the National Academy of Sciences USA,* has laid the polymer down as a thin film, similar to what would be used in a solar cell. But the researchers are still years away from an actual device. Chisholm hopes that even if these polymer solar cells are less efficient than silicon, they will ultimately be cheaper to produce.

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