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Everything Emits Radiation—Even You

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The millirems pour in from bananas, bomb tests, the air, bedmates...

by Stephen Cass, with additional reporting by Corinna Wu

Right now, everyone on Earth is bathed in a soup of radioactive energy. Alpha particles, beta particles, gamma rays, muons, neutrinos: The list is long and puzzling, and most of it has nothing to do with human activities.

The average American gets a dose of around 360 millirems of radiation per year—roughly the equivalent of 36 X-rays. About 200 millirems of that comes from radon gas, a colorless, odorless by-product of natural uranium, found in trace amounts almost everywhere. The radioactive decay of radon gas produces alpha particles (consisting of two protons and two neutrons, an alpha particle is just the bare nucleus of a helium atom), beta particles (which are actually fast-moving electrons), and gamma rays (very energetic photons). Radon is not a problem for most people, but in some locations it can accumulate in houses to dangerous levels.

Medical X-rays come in second place, dosing a person with 53 millirems a year on average. The next biggest external source of radiation is, well, pretty much everything around us, contributing about 28 millirems per year. The food we eat, the clothes we wear, even the paper of this magazine—all are naturally laced with tiny amounts of unstable isotopes, radioactive cousins of normal atoms. For example, all living things require potassium, and one out of every 8,550 potassium atoms is radioactive potassium-40, meaning that all food emits a little bit of radiation. Since bananas happen to be high in potassium, they are actually one of the most radioactive foods. Eating 600 bananas is about the equivalent of having one chest X-ray.

Radiation from cosmic rays comes in next, at 27 millirems per year. Cosmic rays are mostly protons plus a smattering of alpha particles and other atomic nuclei. Their origin is not understood, but they come from every direction in space, traveling at almost the speed of light. Cosmic rays smash into the upper atmosphere, producing a secondary cascade of exotic particles like muons, short-lived heavyweight versions of electrons. Each muon has the same charge as an electron but over 200 times the mass. As the cascade penetrates deeper and deeper into the atmosphere, more and more of it gets absorbed. This means that living in Denver will expose you to more radiation than living in a sea-level city like New Orleans. For every hundred feet of altitude, the annual dose from radiation increases by 1 millirem per year. A six-hour airplane trip will immediately add 2 millirems or so to your annual exposure.

Consumer products like smoke detectors—which rely on a small alpha-particle-emitting lump of americium-241—add 10 millirems per year. Contamination from atomic weapons tests may sound scary, but they contribute less than 1 millirem. (Unless, of course, you happen to be standing next to one.) Nuclear power plants supply the same small dose, on average. Finally, there are neutrinos. These are emitted by the quadrillion from the fusion factory at the core of the sun and usually pass through matter like a laser beam through fog. Occasionally, a neutrino will collide with an atom, adding to your radiation dose. But don't worry—you would have to be alive for a million years to get the same dose from solar neutrinos as you'd get from eating a single banana.

All of the above are external sources of radiation, but 40 millirems of our annual dose is internal, generated from the decay of isotopes incorporated into the molecules of our being: a potassium-40 atom in the brain firing off a gamma ray here, a carbon-14 atom in the liver spitting out a beta particle there. Enough radiation escapes our bodies that sleeping nightly with another person adds 1 millirem to your annual dose. Lead-lined pajamas, anyone?