FILM

Learning from different disciplines

Conversations spark connections as scientists search for inspiration in other fields

By **Brian Uzzi**

If you knocked on Heaven's door, and God greeted you, what question would you ask? What is the nature of human consciousness, and how can it be expanded? Where does the Universe begin and end? What is time, and why isn't it constant? What causes deviance? And further still, if you received an answer, could you decipher it? Or would the answer only be a clue leading to the next clue?

The Most Unknown
Ian Cheney, director
Vice/Motherboard, 2018, 88 minutes. Available on Netflix, August 2018.

The Most Unknown, a documentary film in the Simons Foundation Science Sandbox series, takes the viewer on a fantastical journey of nine scientists as they intrepidly knock on Heaven's door. Each asks a profound question in a different way. But all are making a difference in how science explains the Universe, the world we live in, and the worlds within us.

Microbiologist Jennifer Macalady collects samples from a water source in the Frassasi caves in Italy.

Although the filmmaker, Ian Cheney, is not a scientist, he makes a point that is now well documented scientifically: Scientists from different disciplines who immerse themselves in one another's work and exchange ideas solve the hardest problems (*1*). Midway through the film, for example, California Institute of Technology geobiologist Victoria Orphan describes how tiny microbes, too small to see with the naked eye, can "eat" greenhouse gases and therefore are a potential source of big solutions for climate change. Orphan then travels to Boulder, Colorado, where she meets physicist Jun Ye, who is obsessed with measuring time with a clock so precise that it only loses one second in accuracy every million years. As the two scientists converse, they make a potential connection: The secret to the success of greenhouse-eating microbes may be their particular experience with time. At the bottom of the ocean, strong gravitation waves bend and slow down time, reveals Ye. The change isn't a lot, but it may be a clue to understanding the microbes' specific dietary requirements.

From Boulder, Ye travels to Sussex, United Kingdom, where the world's most accurate clock maker comes face to face with neuroscientist Anil Seth, who studies why humans can't keep time without reference points of activity. In Seth's laboratory, subjects in magnetic resonance imaging machines are asked to guess the runtime of video clips. They find that the human perception of time is linked to the activity level in the video. When persons in a video are highly active or objects move quickly, subjects underestimate the length of the video and vice versa for low-activity videos. One potential implication of his work is that although our life spans are increasing, social media and frenzied news cycles may lead to the perception that life is shorter and less fulfilling.

Science is replete with examples of mysteries that were unlocked through the accumulation of sometimes small and often separate advances that came from varied perspectives. The process of discovery is uncertain. What looks like a breakthrough may prove to be a dead end, whereas accidents may provide a result—a piece of a larger puzzle—that suddenly makes all the other separate pieces make sense collectively.

On an uninhabited island off the coast of Puerto Rico, Seth meets Yale psychologist Laurie Santos, who studies deviance—theft, to be exact. Santos is specifically interested in the conditions under which monkeys in the wild risk taking a five-finger discount of succulent treats. In a moment of levity, an accident messes up the experiment to be filmed, but the presence of the documentary crew reveals something unexpected about monkey behavior: Even if the researcher is looking away, attempted theft is less likely to occur when there are potential third-party witnesses. A serendipitous mistake gives Santos her next clue.

Woven into the film's electrifying tapestry of ideas, persons, and places is the story of the hard work of science. Great discovery, we see, comes part and parcel with emotional frustration and disappointment, unusual hours that buck circadian rhythms, tight spaces, cold water, and dark places.

In *The Most Unknown*, Cheney connects apparently disparate journeys of discovery, illustrating where interdisciplinary teamwork can fill in a scientist's blind spots. When seen through this lens, science can be viewed as a big import-export business of ideas. Conventional, well-understood ideas in one area, when brought into another scientific domain, are suddenly seen in a new light.

Newton's observations that "standing on the shoulders of giants" is key to scientific discovery may only have been half right. As documented in *The Most Unknown*, scientists also have much to learn from their contemporaries. ■

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