# Growing crystals to generate random numbers

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A team at the University of Glasgow has developed a novel way to generate random numbers by using the randomness inherent in crystal growth. In their paper published in the journal *Matter*, the group describes using chemistry to generate random numbers for use in other applications.

Generating random numbers has always been a tricky problem for computer engineers because computers were designed to be as predictable as possible. But random numbers are required in a wide variety of applications in virtually every scientific field. One of the more pressing applications is data encryption—most existing schemes rely on the constant generation of random numbers. Without randomness, computers designed to crack encryption can soon spot a pattern, making it relatively easy to crack the encryption code. In this new effort, the researchers have turned to a real-world process shown to be more random than pseudo-random number generators—a chemical reaction by which a material begins to crystallize.

The process of crystallization is random due to many factors that come into play as chemicals in a liquid solution evolve from a disordered state to one that is very organized. The process demonstrates multiple random characteristics, from its geometry to its formation time.

To take advantage of the randomness of the crystallization process, the researchers created a crystallization array, essentially a cupcake baking pan in miniature. They attached a reagent dispenser and a means for inputting different chemicals into the cups. A camera took a picture of each of the cups as crystal formation began. Each of the pictures was converted to a zero or a one based on nothing but the geography of the crystal. The zeros and ones were then strung together to form a random number.

The researchers tested their random number generator with a common encryption application that ordinarily uses a conventional generator. They encrypted the word "crystal." They then used a common encryption cracking system to crack the system. They found that the cracking system had more difficulty deciphering their word when it was encrypted by their crystal random generator than with conventional pseudo random number generators.

**More information:** Edward C. Lee et al. A Crystallization Robot for Generating True Random Numbers Based on Stochastic Chemical Processes, *Matter* (2020). DOI: 10.1016/j.matt.2020.01.024