

Mysterious desert fairy circles share pattern with skin cells

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Two apparently unrelated systems on vastly different scales – fairy circles in the Namibian desert (left) and microscopic skin cells (right) – appear to share a similar pattern, which is very, very unusual.

Patterns appearing on both the very large and very small scale are extremely rare, but researchers at Okinawa Institute of Science and Technology Graduate University (OIST) in Japan have found a similar pattern in two apparently unrelated systems—skin cells and fairy circles in the Namibian desert.

"It's a completely amazing, strange match," said Prof. Robert Sinclair,



who heads the Mathematical Biology Unit at OIST.

Desert fairy circles are considered one of nature's greatest mysteries because no one knows how they form. Different from mushroom rings, these fairy circles are large barren patches of earth ringed by short grass dotting the desert like craters on the moon or big freckles. Several groups are racing to figure out this bizarre phenomenon. Sinclair and his collaborator, Haozhe Zhang, believe they have identified a small, but vital piece of the puzzle.

The distribution of fairy circles throughout the desert may look random, but turns out to have a pattern that very closely matches the distribution pattern of skin cells. A pattern spanning such drastically different size scales—microscopic skin cells and the desert landscape—is almost unheard of in nature.

"It is still difficult to say why exactly they are similar, but the fact that they are similar is already very important," Sinclair said. "This is suggesting there may be such types of patterns that cover really different size scales."

The research was recently published in *Ecological Complexity*.

To conduct the analysis, Sinclair and Zhang compared the number of neighbors adjacent to fairy circles and skin cells. They took satellite images of fairy circles, and a computer drew lines halfway between each pair of circles to designate invisible boundaries, much like cell walls. The computer then counted how many neighbors surround each fairy circle. Other researchers had calculated skin cell neighbors several years ago.

The results were almost identical. Both the majority of fairy circles and majority of cells have six neighbors. But the similarity gets even more



specific—the percentage of fairy circles with four, five, six, seven, eight and nine neighbors is essentially the same as the skin cells.

"I didn't expect it to be so close," Sinclair said. "We spent a lot of time checking because it really looked too close to believe."

Many theories about how fairy circles form—from rolling zebras to underground gases to dying trees—have been proven incorrect. Now, some scientists are developing mathematical models attempting to explain the origin of fairy circles.

"These models have to incorporate our results," said Zhang, a Ph.D. student in the Department of Statistics at Iowa State University, who conducted the research at OIST with Sinclair in 2013.

The researchers suspect the patterns might be similar because both <u>skin</u> <u>cells</u> and <u>fairy circles</u> are fighting for space. If true, scientists might one day be able to glean information about systems just by analyzing patterns. For example, they could search for signs of life on other planets or moons, where images are usually the only data initially available.

Finding such a pattern could also benefit ecology and biology in general. Understanding processes on one scale could illuminate what is happening at the other end of the spectrum. "Otherwise, we need a whole new theory for each type of system we study, and may miss general principles, or, as some say, not see the forest for the trees," Sinclair said.

More information: "Namibian fairy circles and epithelial cells share emergent geometric order." *Ecological Complexity* Volume 22, June 2015, Pages 32–35. <u>DOI: 10.1016/j.ecocom.2015.02.001</u>



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