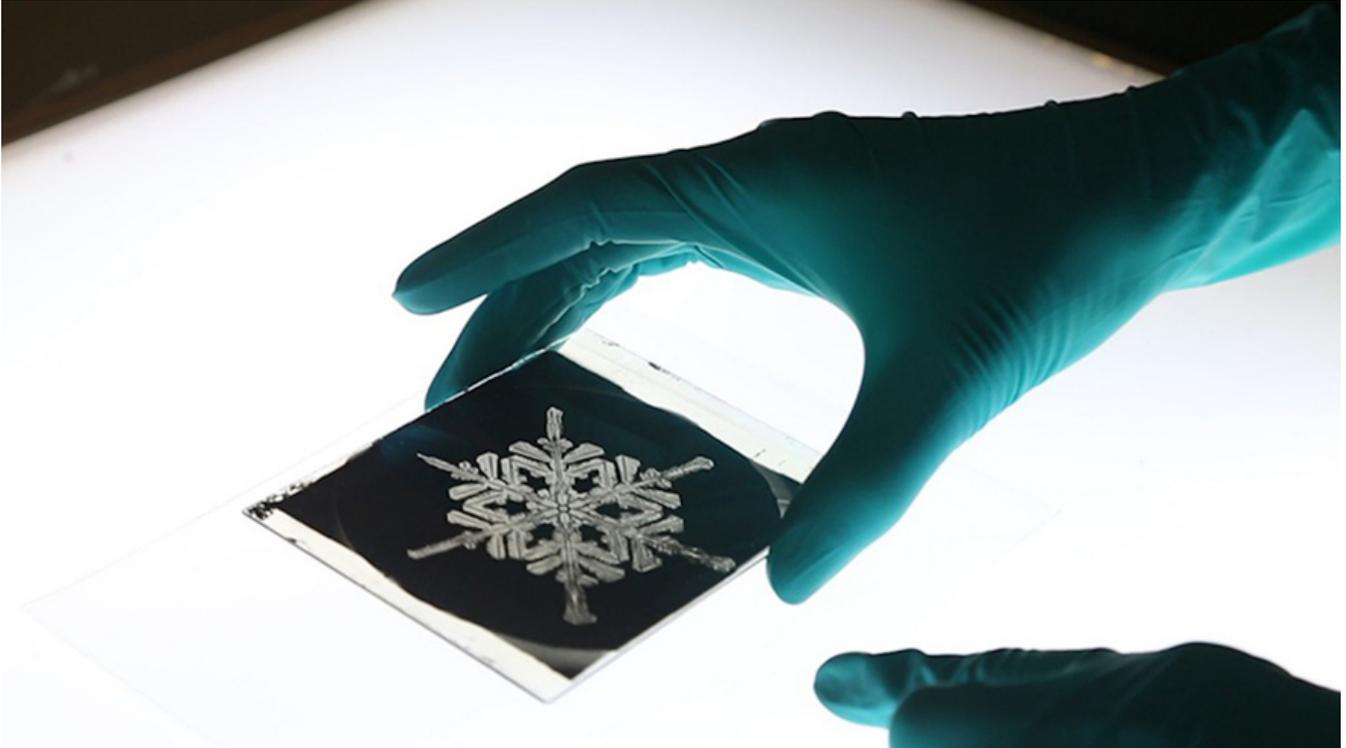


How a self-taught scientist uncovered the secret lives of snowflakes

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Smithsonian Archives preservation coordinator Alison Reppert Gerber examines one of Wilson Bentley's glass slides of a snowflake. Gillian Brockell — The Washington Post

Trying to catch a snowflake is hard. They can be fleeting, turning to vapor not long after they land. But Wilson Bentley's photography has captured and preserved the unique shapes of thousands of snowflakes.

Bentley's photographs are as breathtaking as the day he took them more than a century ago. They are stored in a locked, climate-controlled room at the Smithsonian Institution Archives. Each glass plate contains a single, perfect snowflake that was caught outdoors in subzero weather, magnified under a microscope, photographed and traced by hand to reveal every detail of its form.

"They're just fascinating," said Pam Henson, director of the Smithsonian's institutional history division. "We all see snow all the time. But we don't really see snowflakes."

Bentley Was A Pioneer

Bentley saw snowflakes, in all their complexity and diversity. He is considered a pioneer in the field of photomicrography – taking images of objects under a microscope – and he helped spark scientific interest in understanding the crystal structure of snow. His photographs gave way to research on the atomic structure of water, the intricacies of weather and the conditions that affect how crystals grow. He is credited with discovering that, at least in nature, no two snowflakes are exactly alike.

Born in 1865 in the village of Jericho, Vermont, Bentley was raised to be a dairy farmer like his father. Except for a year or so at the local schoolhouse, he was educated almost entirely by his mother, a former schoolteacher. It was she who gave him his first microscope when he was 15.

The teenager used his new instrument to examine every small thing he could find, but snow interested him most of all.

"Under the microscope, I found that snowflakes were miracles of beauty; and it seemed a shame that this beauty should not be seen and appreciated by others," Bentley would later tell an interviewer. "I became possessed with a great desire to show people something of this wonderful loveliness, an ambition to become, in some measure, its preserver."

At the time, cameras capable of photographing microscopic objects were only just being developed, and none were available to a boy in rural Vermont – Bentley had to invent one himself.

He Made His Own Microscopic Camera

It took two years of trial and error to develop a method that worked. First, he removed the eyepiece from his microscope and connected it to a long camera, and then he placed a black card over the lens of the instrument to act as a camera shutter.

Bentley would catch several snowflakes and examine them with a handheld magnifying glass, lift the best flakes with a feather onto a glass slide and place them under the microscope. He lifted the card acting as his shutter and began counting off the desired length of exposure – anywhere between 8 and 100 seconds.

"The day that I developed the first negative made by this method, and found it good, I felt almost like falling on my knees beside that apparatus and worshiping it!" he told the American Magazine in 1925. "It was the greatest moment of my life."

Over the next years, Bentley amassed a collection of some 5,000 snowflake photographs and published several dozen journal articles on snow, ice and weather. He earned a reputation as a serious citizen scientist, and admirers began to call him the "Snowflake Man." The classification system he developed for flakes is still used today.

By 1904, Bentley decided his growing collection ought to be stored somewhere safe, so he wrote the Smithsonian to see if officials there wanted 500 of his "best examples."

A Curator At The Smithsonian Was Initially Unimpressed

According to Henson, the curator of the geology department at the Natural History Museum was unimpressed by Bentley's offering. After all, Bentley had never gone to college, and he worked as a dairy farmer.

"To someone like the curator, Bentley would have seemed to be an amateur who didn't know much," Henson said.

Luckily, the secretary of the Smithsonian told Bentley that he would pay to have the images copied and stored at the archives.

Bentley sensed that his photographs revealed something important. In 1902, he described in the *Monthly Weather Review* his hunch that the crystal structures of snowflakes reflect the conditions under which they formed.

Temperature, Humidity Help Shape Snowflakes

He was onto something. In the 1930s, Japanese physicist Ukichiro Nakaya began growing the first artificial snow crystals in his lab. Nakaya's experiments confirmed what Bentley had speculated: The shape of a snowflake is controlled by the temperature and humidity of the air in which it crystallized. Snowflakes' symmetric shapes also hint at the behavior of the water molecules they're made of.

Snowflakes have a long history of helping scientists understand the world at the tiniest level – it extends all the way back to the German astronomer Johannes Kepler. In 1610, Kepler became the first person to muse that snowflakes' hexagonal form must be a result of the stacking of frozen "globules". Today, we would call those "globules" molecules.

The "Snowflake Man" never tried to make money from his photographs, although he spent thousands of dollars producing them. It was only at the urging of a friend that he eventually compiled 2,500 of his best images in a book.

"*Snow Crystals*" was published in November 1931, but Bentley didn't get to enjoy much of the acclaim. A month later, he died of pneumonia. He had gotten sick walking in a snowstorm.

Quiz

- 1 Which selection from the article shows that Bentley knew his snowflake images were useful and not just beautiful?
- (A) "Under the microscope, I found that snowflakes were miracles of beauty; and it seemed a shame that this beauty should not be seen and appreciated by others," Bentley would later tell an interviewer.
 - (B) "I became possessed with a great desire to show people something of this wonderful loveliness, an ambition to become, in some measure, its preserver."
 - (C) Bentley would catch several snowflakes and examine them with a handheld magnifying glass, lift the best flakes with a feather onto a glass slide and place them under the microscope.
 - (D) Bentley sensed that his photographs revealed something important. In 1902, he described in the *Monthly Weather Review* his hunch that the crystal structures of snowflakes reflect the conditions under which they formed.
- 2 Which section of the article highlights the idea that not everyone appreciated Bentley's photomicrography work?
- (A) "Bentley Was A Pioneer"
 - (B) "He Made His Own Microscopic Camera"
 - (C) "A Curator At The Smithsonian Was Initially Unimpressed"
 - (D) "Temperature, Humidity Help Shape Snowflakes"
- 3 Which answer choice BEST describes Bentley's approach to studying snowflakes?
- (A) inspired and inventive
 - (B) detached and matter-of-fact
 - (C) unwilling to use trial and error
 - (D) interested in fame and fortune
- 4 What MOST influenced Bentley's initial interest in snowflakes?
- (A) a passion for building microscopes
 - (B) a fascination with subzero weather
 - (C) an appreciation of the loveliness of snowflakes
 - (D) a desire to study snowflake molecules

