For years, scientists have tried to crack a mathematical mystery: Is there an equation that can perfectly describe each and every bird egg? Variable shell shapes complicated things. But it turns out the answer is simple. A formula using just four easily measured dimensions can calculate the shape of any avian egg, be it round as a ping-pong ball, a smooshed sphere, oblong or a curvaceous pear, researchers report in an upcoming issue of the *Annals of the New York Academy of Sciences*.

It was that last shape that had eluded the eggs-perts. They found themselves yoked to an equation that couldn't accurately describe pyriform, or conical, eggs. Previously, researchers developed an equation that accounted for spherical brown hawk owl eggs (*SN: 6/22/17*), elliptical emu eggs (*SN: 10/31/18*), ovoid osprey eggs and other similarly shaped eggs. But that formula didn't apply to the pear-shaped eggs from birds like great snipes and King penguins.

The new formula needs four inputs: the egg's length, its maximum breadth, its diameter at the spot where its pointed end terminates and the location of its maximum diameter in relationship to the midpoint of its length. Adding one additional function and incorporating that last diameter variable to existing egg math led to the universal equation.

The finding could have real-life implications, says Darren Griffin, a geneticist at the University of Kent in England, who did the work along with Kent biologist Michael Romanov and Valeriy Narushin, an agricultural engineer formerly at Kent. For example, being able to calculate an egg's shape could help designers create better padded or form-fitting egg containers, minimizing grocery store waste or that disappointing moment of arriving home with a carton of eggs, opening the lid and finding your eggs cracked. "We're all supposed to check in the box" before leaving the store, but it's easy to forget, says Griffin.

The equation could also come in handy in conservation efforts. When reintroducing a bird species, "one of the considerations would be 'How likely are the eggs to break?'" Griffin says. Knowing an egg's math could help researchers calculate what parts are most vulnerable to cracking, which in turn could help them assess where and how best to place them in certain habitats to help grow the population in those areas.

The formula's simplicity "makes this approach practical for field studies" and could even enable researchers to collect the measurements from digital photographs, says Mark Hauber, an ornithologist at the University of Illinois at Urbana-Champaign. "My lab had been working on something like this, but we weren't able to derive the new math." His recent work has focused on determining "how birds themselves can tell if an object is naturally egg-shaped or an artificial shape that shares some of the geometry with natural eggs."

The discovery of the egg equation came while the researchers were exploring how to nondestructively assess the sexes of avian embryos before eggs are incubated. They were looking for physical differences between the attributes of eggs containing female and male embryos, Narushin says. The universalformula is an initial step in “resolving such an enigma.” Now they’re working on a new brood of eggproblems, searching for a universal formula for computing the volume and surface area of various eggs,as well as exploring “mathematical shell secrets,” such as why shell thickness differs by species.

Source: **An elusive equation describing bird eggs of all shapes has been found at last**