“EGG-SHAPED” is a common phrase we use for comparison of the shape of objects. However, this is far away from the exact description, as birds lay eggs of different shapes: pointy, oblong, oval and even round. Owl’s eggs are spherical, while the huge ostrich eggs are wide; a Sandpiper lays eggs that are pointy on one side, while the humming birds lay tiny, elliptical ones.

‘Of course, in most cases, our reference is the regular chicken egg which is oval in shape and is roughly in the middle of this spectrum of forms.

Isn’t it fascinating that so much diversity exists in bird-eggs, while the core idea of egg-laying is to nourish the growing young one? Why should there be so much variation and what are the secrets hidden behind this diversity?

These questions and much more have intrigued biologists, naturalists and scientists for centuries. In fact, the shapes of eggs have fascinated even physicists and mathematicians too, for the hidden engineering in them. Many have given their versions of interpretation. Centuries ago, Aristotle conjectured that oval eggs indicate a female offspring while round ones to males! Now, we know how farfetched this theory is.

Why are birds’ eggs so different? Perhaps we can correlate the size of an egg to that of the bird, but why such an array of shapes and colours and patterns on them? Among avian eggs, the distribution of the bulk of the yolk is also found to differ.

A unique research study published in the journal *Science* in June 2017, has found a surprising correlation between the shape of a bird’s egg to its ability to fly. This interdisciplinary study was conducted by a diverse group of scientists – biologists, mathematicians, physicists, computer experts – and brought together contributions of scientists from four nations. The lead author Mary Casey Stoddard, and her co-researcher L. Mahadevan explained in detail to the media about the methods they employed and the results of the research.

Stoddard is Assistant Professor in the Department of Ecology and Evolutionary Biology, Princeton University, Princeton, while Mahadevan is from the Departments of Organismic and Evolutionary Biology, and Physics, Harvard University.

**Ancestors Were Dinosaurs**

From Tyrannosaurus to Archaeopteryx, birds evolved from the Theropods – which were two-legged predatory dinosaurs. As they took to flight, in a patchy fashion, their bodies began to change to suit this.

Evolutionary biologists say, “Palaeontologists once supposed that the earliest bird, 150-million-year-old *Archaeopteryx*, represented a significant evolutionary leap from dinosaurs. It took 80 million years of further evolution after *Archaeopteryx*, for the entire body plan to come together. After this the development was rapid, and the birds began to evolve further: soon they lost weight and started developing strong wings for flight. Archaeological evidence indicates that the eggs of these flying dinosaurs were pointy in shape,” reports *National Geographic*.

**Unique and Thoughtful**

This one-of-a-kind research finds answers to the diversity and also opens up avenues to many more puzzles the array of eggs hold.

For their study, the team catalogued digital samples of nearly 50000 eggs belonging to 1400 species (both extinct and
Astonishing Results

Their next step of analysis was to study the evolutionary details of egg shapes. What could the pressure on the membrane be before hatching? How did this pressure affect the growth of the chick? What were the critical factors that affected the growth?

In answer to these queries, The Wire reports: First the scientists theorised that the shape of eggs depended on the nesting habits. For example, gulls eggs are pointed on one side, and they lay eggs on cliffs and ridges. The reason was thought to be to accommodate the maximum number of eggs under the brood patch (a featherless area on the belly of the bird which has a rich supply of blood to incubate the eggs). Again it was thought that due to nesting habits, such eggs tend to spin when bumped off rather than roll down. This way it was a survival mechanism.

Though these aspects played a significant role for birds, the researchers found that these variables did not fit into a global model and hence could not be generalised.

However, during the analysis, the researchers found a strong correlation between the hand-wing index – a measure of the shape of the wings – to rate or flight efficiency – and egg shape. Birds with narrow pointed wings, like swifts and sandpipers, rank high on the index than ones, such as owls, with short wings and rounded tips. Strong fliers, the ones with a high index score, tend to have oval or conical eggs.

Here their hypothesis points to the astonishing relationship of egg shape and flight ability of a bird. “We discovered that, on a broad scale, egg shape is related to flight ability in birds. We think that birds, to maintain sleek bodies for flight, have evolved elliptical and asymmetric eggs to increase egg volume without increasing egg width – this is advantageous for narrow, streamlined bodies,” says Stoddard.

“Perhaps, evolutionarily, birds stumbled upon this very natural, geometric solution, which is to increase the ellipticity and asymmetry of their eggs,” adds Mahadevan.

What about penguin eggs? As an exception, penguins’ eggs are pointy and asymmetric, despite the bird being flightless. “We believe that penguins’ bodies are adapted for powerful swimming, and so perhaps the same processes that influence egg shape in flying birds are at work in swimming birds as well,” clarifies the scientist.

It is found that the volume of an egg depends on the state of the newly hatched chick’s development. Chicks may be born entirely helpless, or able to survive. Some can walk and swim but need to be fed by their parents. Others follow their parents and find their food. The ability of a chick to fend for itself independently is dependent however on the size of the egg. The more independent the chick after hatching, the larger the egg.

In conclusion, experts opine that this research, while challenging long-standing assumptions, also opens up avenues to discover many more truths hidden behind the formation of something as common as an egg.

Ms Susheela Srinivas is a freelance science writer. Address: #189, I F Cross, 3rd stage, 4th block, Basaveshwaranagar, Bengaluru-560079; Email: sushsri@gmail.com