Bumble Bee can't Fly Urban Myth

"Like the bumblebee, they said it could never fly."

This statement appears in a recent issue of Popular Science, starting off an article about drag racing.

Indeed, the venerable line about scientists having proved that a bumblebee can't fly appears regularly in magazine and newspaper stories. It's also the kind of item that's bound to come up in a cocktail party conversation when the subject turns to science or technology.

Often, the statement is made in a distinctly disparaging tone aimed at putting down those know-it-all scientists and engineers who are so smart yet can't manage to understand something that's apparent to everyone else.

Obviously, bumblebees can fly. On the average, a bumblebee travels at a rate of 3 meters per second, beating its wings 130 times per second. Quite respectable for the insect world.

So, how did this business of proving that a bumblebee can't fly originate? Who started the story? It apparently first surfaced in Germany in the 1930s, and the story was about a prominent Swiss aerodynamicist. One evening at dinner, the researcher happened to be talking to a biologist, who asked about the flight of bees. To answer the biologist's query, the Swiss engineer did a quick "back-of-the-napkin" calculation.

To keep things simple, he assumed a rigid, smooth wing, estimated the bee's weight and wing area, and calculated the lift generated by the wing. Not surprisingly, there was insufficient lift. That was about all he could do at a dinner party. The detailed calculations had to wait.

To the biologist, however, the aerodynamicist's initial failure was sufficient evidence of the superiority of nature to mere engineering. The story spread, told from the biologist's point of view, and it wasn't long before it started to appear in magazine and newspaper articles.

Unfortunately, the wrong lesson emerged from the story. The real issue is not that scientists are wrong but that there's a crucial difference between a thing and a mathematical model of the thing.

The distinction between mathematics and the application of mathematics often isn't made as clearly as it ought to be. In the mathematics classroom, it's important to distinguish between getting the mathematics right and getting the problem right. It's quite possible, for instance, to calculate correctly the area of a rectangular piece of property just by multiplying the length times the width. Yet one can get the "wrong answer" because the measurements of the length and width were inaccurate or there was some ambiguity about the boundaries.

The word problems typically found in textbooks also serve as rudimentary models of reality. Their applicability, however, depends on the validity of the assumptions that underlie the mathematics.

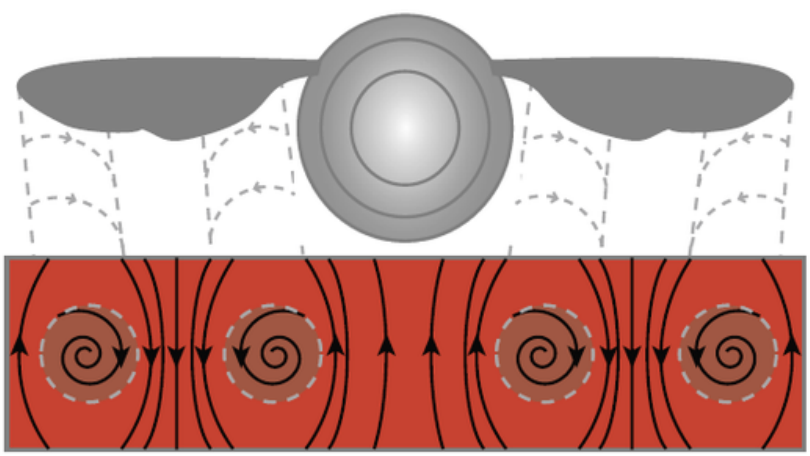
So no one "proved" that a bumblebee can't fly. What was shown was that a certain simple mathematical model wasn't adequate or appropriate for describing the flight of a bumblebee. Insect flight and wing movements can be quite complicated. Wings aren't rigid. They bend and twist. Stroke angles change.

Yet the myth persists that science says a bumblebee can't fly. This tale has taken on a life of its own as a piece of "urban folklore" on the Internet, passed on from one browser to another.

Extra! How Bumblebees Fly:

Successfully kayaking a stretch of white water depends in large part upon skirting vortices, swirling whirlpools that can trap a boater in recirculating waters.

Bumblebees, it turns out, must pull off a similar feat to stay aloft. Unlike boaters, however, they create their own vortices. Physicist Z. Jane Wang of Cornell University has shown that managing vortices is key to insect flight, and that the unique figure eight motion traced out by a flapping insect wing creates lift by turning eddies to the bugs' advantage.



In the power stroke of a wing flap, two vortices form: one in front of the wing, which rotates clockwise, and another at the back, which spins counterclockwise. At the bottom of the power stroke, the insect rotates the wing ninety degrees, a maneuver that rolls the swirling currents off the wing surface. Moreover, this rotation sends the two vortices swirling together, forming a single coherent airflow that provides the insect with lift.

The research finally puts bumblebee flight on solid theoretical ground, giving up the lie to the old myth that bees defy aerodynamic law.