"[The force] is created by a net upward air pressure, which in turn is created by the bird's forward motion and the shape of its wings. The topside of an avian wing is curved, while the bottom side is rather flat. This difference in shape, together with the angle and some smaller adjustments of the wing, cause the air to flow over the top of the wing at higher speed than on the bottom. The higher speed on top reduces the air pressure above the wing compared to the air pressure below the wing. With more pressure pushing up from below than pressure pushing down from above, the wing gets an upward lift.

"Air consists of little molecules that push against whatever they strike, causing pressure. Molecules of air are constantly whizzing about in all directions. If no energy is added, the total speed of the molecules must be constant, by the law of the conservation of energy. But that speed is composed of two parts: a horizontal speed, parallel to the wing, and a vertical speed, perpendicular to the wing. Increase the horizontal speed of air molecules above the wing, and the vertical speed of those molecules must decrease. Lower speed of molecules striking the wing from above means less pressure, or less push. The molecules on the bottom of the wing, moving slower in the horizontal direction but faster in the vertical direction (with greater upward pressure), lift the wing upward.

"The lift is greater the larger the wing area and the faster the speed of air past the wing. There's a convenient trade-off here. The necessary lift force to counterbalance the bird's weight can be had with less wing area if the animal increases its forward speed, and vice versa. Birds capitalize on this option according to their individual needs. The great blue heron, for example, has long, slender legs for wading and must fly slowly so as not to break them on landing. Consequently, herons have relatively large wingspan. Pheasants, on the other hand, maneuver in underbrush and would find large wings cumbersome. To remain airborne with their relatively short and stubby wings, pheasants must fly fast.

"As you scale up the size of a bird or any material thing, unless you drastically change its shape, its weight increases faster than its area. Weight is proportional to volume, or length times length times length, while area is proportional to length times length. Double the length, and the weight is eight times larger, while the area is only four times larger. For example, if you have a cube of 1 inch on a side, its volume is 1 cubic inch, while its total area is 6 (sides) × 1 square inch, or 6 square inches. If you double the side of the cube to 2 inches, its volume goes up to 8 cubic inches, or 800 percent (with a similar increase in weight), while its area goes up to 24 square inches, or 400 percent. Since the lift force is proportional to the wing area while the opposing weight force is proportional to the bird's volume, as you continue scaling up, eventually you reach a point where the bird's wing area is not enough to keep it aloft. Although birds have been experimenting with flight for 100 million years, the heaviest true flying bird, the great bustard, rarely exceeds 42 pounds. The larger gliding birds, such as vultures, are lifted by rising hot air columns and don't carry their full weight.

"Birds do in fact have propellers, in the form of specially designed feathers in the outer halves of their wings. These feathers, called primaries, change their shape and position during a wingbeat. Forward thrust is obtained by pushing air backward with each flap. In a similar manner, we are able to move forward in a swimming pool by vigorously moving our arms backward against the water." - Alan Lightman, The Miraculous from the Material: Understanding the Wonders of Nature

["All of this helps explain why larger birds often fly in a V formation — each bird benefits from the uplifting air pockets produced by the bird in front of it, conserving 20 to 30 percent of the calories needed for flight compared to flying solo. Because the lead bird takes most of the aerodynamic and caloric brunt shielding the rest from the wind, the flock takes turns in the frontmost position." - Maria Popova]