Competition 3: Evolution of flight

In the late Jurassic period, birds evolved from small carnivorous dinosaurs called theropods. The only flying creatures were insects who are believed to have been flying for at least 320 million years.

One of the most important aids for birds to fly are feathers, assisting with aerodynamics. The first theropod were ancestors of the dinosaur Compsognathus having short, hair-like feathers covering their heads, necks and bodies providing insulation. It's unknown why they had different patterns, however some theories are they were for camouflage, display or species recognition. In theropods closely related to birds such as the Dromaesaurid, they had a vane-like structure. This structure was well organised and locked together by barbules; research shows the feather is identical to modern day birds. It is thought that the long feathers, that later appeared on birds, could be used to warm eggs, shielding them from harm.

The first theropod had hands with a small 4^{th} and 5^{th} digit and a longer 2^{nd} digit; eventually the 4^{th} and 5^{th} digits were lost. Wrist bones underlying the 1^{st} and 2^{nd} digits consolidated taking on a semi-circular form allowing rotation sideways against the forearm. This eventually allowed birds' wing joints to move to create thrust for flight. The wishbone, which also appears in many other dinosaurs, became stronger and more pronounced and the shoulder girdle bones became connected to the breastbone. This meant the ridge along the breastbone to which the muscles to aid flight are attached, became larger and more central, known as the keel. The importance of the keel being larger was to better anchor the muscles enhancing flight. It is thought birds had bony tails, which became reduced to a stump and a spray of feathers, improving stability and manoeuvrability when flying.

Birds have many small airs sacs in the lungs that create a large surface area to volume ratio, allowing diffusion to take place quickly maintaining a constant oxygen level. The respiratory system of a bird makes up 1/5 of its body weight; through evolution, a one-way system was implemented to increase the efficiency of breathing. The adaptations allow birds to take less breaths per heartbeats (1 breathe every 6 - 10 heartbeats depending on the size of the bird). Thereby aiding the bird to combat difficulties of flying.

In theropods, the arms became longer than the legs due to the fact that flying developed into its main form of transport and not running. Birds evolving from a dinosaur called Archaeopteryx, were toothless with many bones fused together thus reducing the overall number of bones in its body. To increase the efficiency of flight its feathers evolved, and became longer. It had asymmetrical vanes and thinner bone walls which contributed to the improvement of flight.

There are varying hypotheses amongst scientists about the purpose behind the evolution of wings. Some believing they evolved from arms to capture small prey, others believing they evolved because animals were leaping into the air and wings assisted them in this task. Research in China has discovered that a bird's brain is usually bigger in proportion to the rest of the bird's body in order to assist the birds with their vision and coordination when flying.