A Top Flight Example - Part 2

The feathers are the key element in the collection of resources which make the flight of birds possible. These are formed in tiny follicles in the outer layer of skin, which produce keratin protein. One of the varieties of keratin is the material of mammals' hair, horns and hooves. But an even more rugged variety of keratin is in birds' beak, claws and feathers. The feather follicles produce polymer strands of the protein, keratin, which are then pleated into sheets and further twisted and cross-linked in a biochemical process.

Now, using this fully-prepared structural material, the follicles send up feathers in two basic forms. The fluffy down feathers form the bird's warm underwear, while the vaned feathers cover the exterior of the body. As shown in the diagram the keratin produced in the follicle is in some unknown way configured into the complex, branched structure of the vaned feather. The **main hollow shaft** emerges, with branches called **barbs**. To give the barbs strength, they are thicker on the side of the wing facing outwards while the bird is at rest. The cross-section is like a knife blade, sharp side down. With this shape the barbs give the maximum strength when the wing is extended. The barbs in turn have their own little branches called **barbules**. Precisely located along the barbules are tiny **hooks** which hold the hundreds of branches and branchlets together to form a single functioning vane. When a bird preens, it runs the length of the feather through its bill, engaging the hooks and uniting the barbs into the precisely shaped vane. On the downstroke of the wing the hooks remain engaged, but on the upstroke the hooks relax their hold and permit air to pass through. Also, since the wing is an airfoil - thick leading edge and thin trailing edge, with convex upper surface and flat or concave lower surface - the air pressure during flight is lower on the top which keeps the hooks in the flight feathers firmly engaged.

But birds can make even a stunt plane look like a crude toy. The flight control mechanisms in a bird are far more intricate than those in an aircraft. In flight, the part of the wings closer to the body provide the lift. But the outer part of the wings provide the forward thrust, the wing tips moving at right angles to the direction of flight. Generally four pairs of very small feather muscles in the skin run from each feather follicle to surrounding follicles. These muscles adjust the position of the feathers in a manner to give a varied pitch according to their position on the wing.

On command, the direction of flight can be changed to carry the bird straight upwards. Or if required the feathers can be redirected to cause the bird to fly backwards. Again, the feathers may all be flattened to soar on air currents, or during a lull in updraft, the wing can be reshaped to act as a parachute.

Among evolutionists, one idea was that some species of reptile took to the trees and over a very great number of generations adapted its physical form to that of a bird. It was suggested that the waving of the reptile's forelimbs as it continually leaped upwards encouraged the elongation of the scales on those limbs. Moreover, the motion frayed the outer edges of the scales, gradually changing them to feathers. But such a process is now admitted to be impossible, since DNA cannot be reconfigured by such physical actions of the animal. The change from reptile scales to bird feathers, it is now maintained, had to wait for random imperfections in the copying of the DNA, and so feathers are regarded as mutant reptile scales. More about this, God willing, next time.