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## Science and the Angels



### Interesting Calculations Which Prove Their Wings Are Useless for Flying, Show How Annoying the Really Effective Mechanism Would Be, and Indicate That Man Would Have to Be Entirely Re-Made to Become One

#### WHAT AN ANGEL OUGHT TO LOOK LIKE.

The First Drawing Shows the Fifteen-Foot Stretch of Wing, with an Average Width of Three Feet, Which Science Says is Necessary to Raise a Creature of 160 Pounds. The Immense Chest, So Different from That of the Traditional Angel, is Composed of the Muscles Necessary for Flying.

The Second Drawing Illustrates How the Fifteen-Foot Wings Would Appear if They Took the Place of Arms, as They Do in the Rtd. This, if Compared with Burne-Jones's Angel on Another Part of This Page, Shows How Inadequate Would Be the Latter's Wings for Flying, Such a Length as the First Would, However, Make Standing or Sitting Very Uncomfortable, and the Angel Could Not Feed Himself.

The Third Figure Illustrates the Enormous Development of the Back Which Would Be Necessary if the Wings Sprang from the Shoulder-blades, as They Are Ordinarily Depicted as Doing.



consists of little else than this bone. The same gigantic feature is notable in the skeleton of the prehistoric pterodactyl, the greatest flying creature ever known, which weighed only thirty pounds, less than a fifth the weight of the average man or angel.

To use his thirty feet of wings, the bare limit necessary to keep him aloft, the 160-pound man would have to develop a breast bone which would be big enough to cover his chest and at least three-fourths of his abdomen. This would, in its turn, demand various rearrangements of his internal organs and an entirely different length of rib. Besides this, the mass of muscles required on his chest would make him ap-

plies, it is seen, in his legs. Few men could walk upstairs on their hands, and no man could develop one horsepower running upstairs on his hands. And yet it is this part of the anatomy which is the most useful in flying. And so we must assume that, even if angels have the fifteen feet long wings which science says they must have, they have not, from their pictures, the necessary chest mechanism to work them.

An angel with wings of such dimensions is, in fact, far different from any depicted, even in song or story, but there is still another difference. How many people realize that the angel as shown in the pictures has really six limbs. The bare feet, for flying, like swimming, seems to be impeded by shoes, are evidence of one pair of wings. The arms and hands form another pair, and the wings form a third pair. Now the wings of a bird are developments of the same group of bones that makes the arm and foot of the human being. The wing proper is an extension of the thumb and the first finger. The arm bones—the humerus, the radius and the ulna—have disappeared because they were of no importance to the bird. In the conventional idea of the angel the wings are fixed to the back of the shoulder blades—but where is the ball and socket joint in which they could move? What particular kind of blood supply would go into the wings? What is the muscular tissue?



ART has given us our idea of what angels look like. From the time of the old masters until recently they have been portrayed as more or less intelligent faced, smooth-shaven men, usually six feet high and weighing presumably around 160 pounds. They have arms and legs and an apparently normal body, except that a pair of wings emerge from their shoulder blades.

There are no women angels, although, as will be seen later, the bodily structure of woman is more adapted to angelhood than is man's.

A number of interesting calculations and observations upon angels, as given us by art, have recently been made by scientists. They are important because they seem to show that no angels, built as we know them, could possibly fly. Nor could man as he is built now possibly be a flying angel. They seem to show, in fact, that no mammal could fly. None is fitted for both arms and wings.

The main object of angels' wings would seem to be to fly, but science says that the traditional swan effect would depend upon some muscular device utterly unknown to anatomy. If it is objected that angels are incorporeal and not of the actual weight that they seem to be—have, in fact, no weight—then it may be properly asked, Why the wings? In all the pictures these are exceedingly substantial and are shown as the actual motive power of the angel. This being so, science, the whole matter must be analyzed from the basis of material, purposeful wings—and this implies a material body, which is just what it seems to be and which is lifted and carried through the air by these wings.

By an elaborate series of calculations science has discovered that the average 160-pound man or angel would need, at the outset, wings fifteen feet in length to lift himself from the ground. That is, he would have to measure at least thirty feet from tip to tip, or about five times his height.

But, after giving him the wings, the difficulties increase. All the higher forms of life grew from a common ancestor. At one time we were all reptilian. The bird's ancestors were reptiles. The feathers are only developed scales. Both snakes and birds still lay eggs. Man grew up from his reptilian progenitors through a series of forefathers, who went on all fours. While the fore feet of the reptile were turning into the wings of the bird, they were turning into hands for us.

During this process our bodily structure was profoundly changed. This was particularly true of the skeleton. Walking on all fours, the mammal did not need the muscles of his chest to be enormously developed. And so they were not. The breast bone, which is the foundation of the chest muscles, did not therefore, grow to any size in the mammal. On the other hand, the action of flying necessitates extraordinarily powerful chest muscles. The breast bone of the bird is therefore the largest bone of its body. A glance at the comparative skeletons of man and bird, on this page, will show the enormous difference in their sizes.

Man, with his puny breast bone, has no foundation upon which the muscles essential to move a thirty-foot spread of wings could attach themselves. The angels seem to have the same breast formation as man. The giant condor, in most respects the largest bird on our planet, bears a chest whose framework

pear exactly like a pouter pigeon, while Hercules himself would, in comparison, seem to have no chest at all.

Dr. F. A. Lucas, Director of the Museum of Natural History in New York and an international authority on flying creatures, points out that three things are to be considered in flying—the horsepower of the creature, its weight in pounds and its supporting wing area in square feet.

The ratios of these three factors are not the same in all birds, and they differ greatly, although systematically, with absolute weight.

It is an obvious mathematical law that the area in bodies increases as the square of their dimensions, while their weight increases as the cube of their dimensions. From this it is an apparently plain inference that the larger the creature or the machine, the LESS the relative area of support may be. It is this law which adds another difficulty to man or angel flying, and which certainly would seem to prevent an elephant from ever having wings.

To demonstrate: If in a soaring bird, which we may suppose to weigh two pounds, we should find that it had two square feet of wing surface, or a ratio of a foot to the pound, it would follow, from the law just stated, that in a soaring bird of twice the dimensions we would have a weight of sixteen pounds and an area of eight square feet. This would mean only half a square foot of supporting area to a pound of weight, so that, even if flight is possible in the first case, it would be wholly impracticable in the second. The difference is seen to grow greater as we increase the size. For when we have a creature of three times the dimensions of the first bird we shall have twenty-seven times the area and only nine times the sustaining surface, which is but one-third of a foot to the pound, and so, science says, we cannot have a flying creature much greater than the limit of area of the condor, unless it is endowed with extraordinary strength of wing.

And so we are thrust back again upon the difficulty of angel motive power. Taking the condor again as a standard, we have a flying creature with one-twentieth of a horsepower as an angel, seventeen pounds weight and a supporting wing area of ten square feet. Assuming the horsepower to vary directly as the weight, we find that the flying horsepower of the average man weighing 160 pounds and having a ninety square foot wing area, must be approximately one-half a horsepower. Now, it is a fact that the average man can generate only one-ninth of a horsepower. This one-ninth standard has been proven true after time in experiments at Washington, too complex to go into here. It can be accepted as a fact. Again, from a curve plotted by Dr. Lucas, taking as the base of calculations twelve different birds of different weight, wing area and power, he has determined that for a 160-pound creature six-tenths of a foot of wing surface per pound is required, or ninety square feet in all. This is nine times the wing area of the condor, and the resulting dimensions for the average man would be forty-five square feet for each wing. Each wing would thus have to be fifteen feet long and average three feet in width.

The one-ninth horsepower that a man has would be utterly insufficient to raise these wings. A man running upstairs at great speed, two or three steps at a time, develops, for a few instants, as high as one horsepower. This is his limit, and his greatest strength

If we concede the difference of wing space and horsepower to be overcome, we still have the enormous difficulty of the profound modifications of the whole muscular and skeleton back to meet. If an angel has ball and socket joints in his shoulder-blades he is not man-like, and if man should in some way develop joints, he would cease to be a man.

The whole truth of the matter is that no mammal is built for both wings and arms. It is scientifically impossible for wings to grow out of one's shoulder-blades.

It has been said that there are no women angels. In the Old Masters the angels are almost invariably men, the exceptions, sexless. In the winged hierarchy of the heaven there are no names of women. Women are made saints, it seems, but never angels. We read in the Talmud of the "Sons of God," but of the "Daughters" we hear nothing. This is curious because woman, through her physiological differences from man, is better adapted for flying. She has less specific gravity; her bones are lighter and more hollow and closer approximating the bird; and she has larger chest muscles. That she has a greater facility for "going up in the air" than man is a statement which has no place in a serious discussion.

All this raises some very interesting speculations as to the annoyances of being an angel. The ninety feet of wing area would demand a great deal of space for each bearer. If some one wanted to address a hundred or more angels they would have to do it through a megaphone because they would take up with their wings the same room that a crowd of several thousand men would. Again, there is the question of how they would dispose of their wings. They positively could not sleep on their backs or on their sides. The enlarged chest would make it impossible to sleep on their stomachs. Doubtless they might have some kind of hooks on the top of their wings and hang themselves up at night, like certain kinds of bats, which suffer from the same annoyances.

It is also doubtful if an angel could alight from the air with dignity. Any one who has seen a large bird or a monoplane either alight or ascend, cannot do this. There would be an enormous flapping of wings, like a chicken jumping down from the fence, or else they would skim down like an aeroplane landing, and this would involve running very fast indeed for a hundred feet after they touched the earth. In the same way, to ascend they would have to run and jump until the air got under their wings.

There, too, is the problem of sitting down. The enormous length of wing, two and one-half times the height of the angel, would prevent them from sitting on ordinary chairs. In the light of these calculations that old hymn of our childhood, which runs,

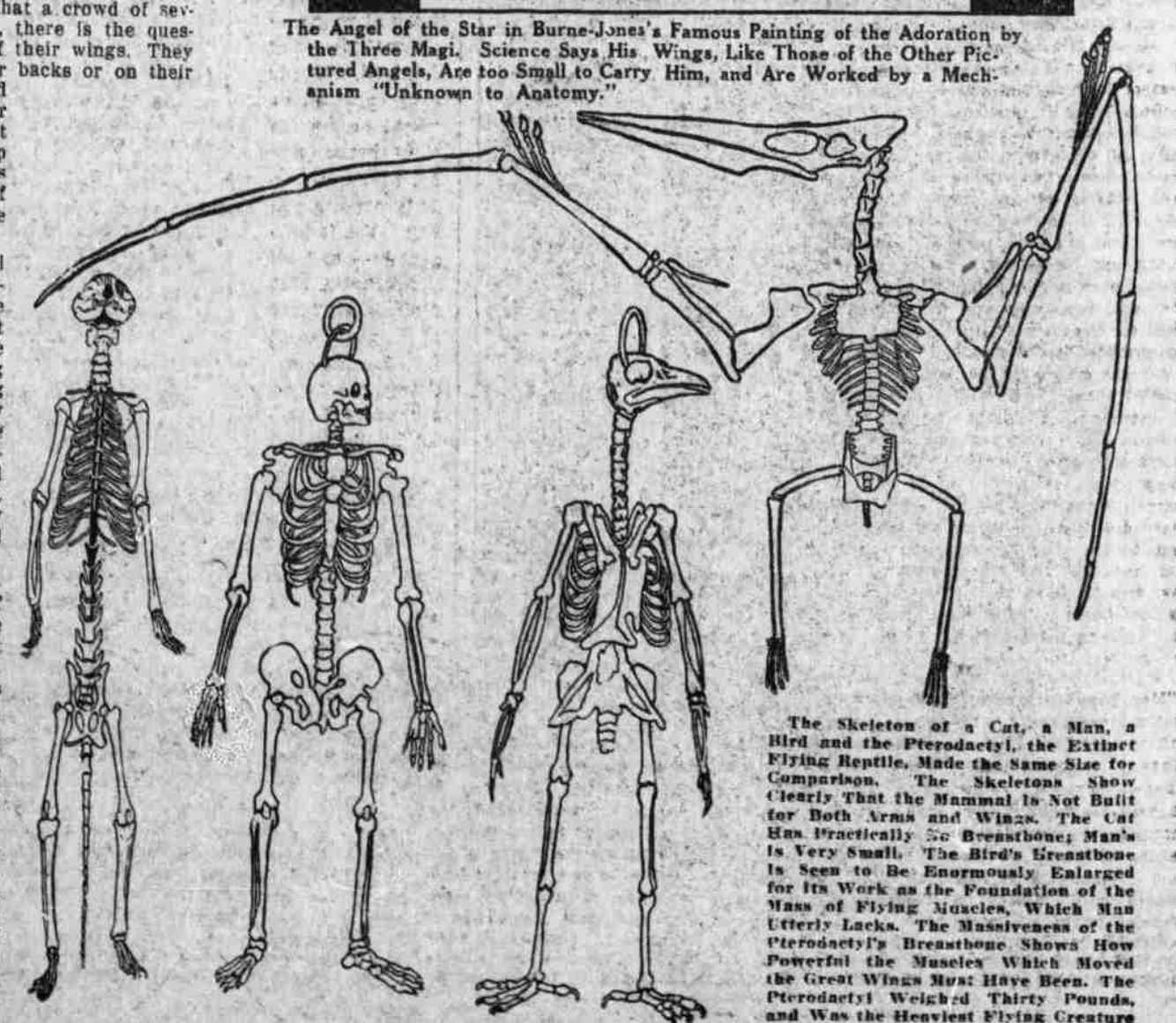
"The blessed souls stand ever in the light,  
All rapture through and through,"

would have a new and literal meaning. Any crowd of angels would stand so thoroughly in the light that no one could possibly read the largest print because of the shadow of their wings.

Of course, all these speculations are based only upon scientific deductions.



The Angel of the Star in Burne-Jones's Famous Painting of the Adoration by the Three Kings. Science Says His Wings, Like Those of the Other Pictured Angels, Are Too Small to Carry Him, and Are Worked by a Mechanism "Unknown to Anatomy."



The Skeleton of a Cat, a Man, a Bird and the Pterodactyl, the Extinct Flying Reptile, Made the Same Size for Comparison. The Skeletons Show Clearly That the Mammal is Not Built for Both Arms and Wings. The Cat Has Practically No Breastbone; Man's is Very Small. The Bird's Breastbone is Seen to Be Enormously Enlarged for Its Work as the Foundation of the Mass of Flying Muscles, Which Man Utterly Lacks. The Massiveness of the Pterodactyl's Breastbone Shows How Powerful the Muscles Which Moved the Great Wings Must Have Been. The Pterodactyl Weighed Thirty Pounds, and Was the Heaviest Flying Creature Perhaps Which Ever Existed.