pectation that the results sought will be attained. Nature is more successful in applying the law of compensations to the correction of errors of design or development than man has ever been or is ever likely to be. The bird which cannot fly at all, or not very well, usually does not need to; but if the time ever comes when it does need to, its differentiation is gradually but certainly effected along natural lines.

It should be remembered, however, that the bird successful in flight is an evolution. It has taken a great many generations of his kind to develop his muscular system in just the right way for flying purposes, and very likely the process has consumed many centuries of time. The mistake of the scientist would appear to be in his assumption that he can do with much less suitable material by a single act of creative genius what nature accomplishes with such immeasurable deliberation. It may also be that he has failed to recognize the difference between matter which is passive and must be differentiated and matter which may be said to co-operate with the creative purpose and to assist the process of differentiation by effort. The bird that wants to fly and feels the need of flight tries to fly, and keeps on trying until it can fly as well as it needs to. The machine does only what it must do in obedience to natural laws acting on passive matter. Hence, if it requires, say, a thousand years to fit for easy flight a bird which started with rudimentary wings, or ten thousand for one which started with no wings at all and had to sprout them ab initio, it might be assumed that the flying machine which will really fly might be evolved by the combined and continuous efforts of mathematicians and mechanicians in from one million to ten million years—provided, of course, we can meanwhile eliminate such little drawbacks and embarrassments as the existing relation between weight and strength in inorganic materials. No doubt the problem has attractions for those it interests, but to the ordinary man it would seem as if effort might be employed more profitably.

FLYING MACHINES WHICH DO NOT FLY.

The ridiculous fiasco which attended the attempt at aerial navigation in the Langley flying machine was not unexpected, unless possibly by the distinguished Secretary of the Smithsonian Institution, who devised it, and his assistants. Prof. MANLY, who undertook the voyage, prudently clothed himself in a cork jacket—doubtless because cork is a good non-conductor and would tend to keep the wearer warm in the rarefied strata of the upper atmosphere in which he perhaps expected to cruise. However, as the machine was to be launched over the Potomac, it appears, as matters eventuated, to have been a wise precaution for other reasons. At the supreme moment the device was shot down the incline from which it was to derive, by gravity, its initial momentum. When the instant came when it was to defy gravity it behaved very much like a card skillfully scaled by an expert. But for its wings and aeroplanes it would have dropped from the end of the shoot by a very short trajectory, upon whatever might have been under it. As it was, it described a relatively long and very graceful trajectory, the chord of which was about a hundred yards, and when its impetus was exhausted gradually curved downward until it disappeared, "plunk," as the small boy would say, into the river. Thanks to his cork jacket, Prof. MANLY came to the surface thoroughly wet, but smiling, explanatory, and delightfully confident that the principle of the Langley device is all right, and eager to make a report to this effect to his principal, who had prudently remained in Washington.

The proverbial proneness of the unexpected to happen, especially in the case of flying machines, has been demonstrated too often since the days of Icarus to leave room for surprise that gravity was too much for the Langley mechanism. That it ought to fly as well as the average hen hawk is probably true. Prof. LANGLEY and his assistants are very learned men. Not one of them is an empiric in science or in the least hazy as to exact mathematics. They have undoubtedly worked out the equations of levitation, so to speak, with infinite patience and infallible exactness. The difficulty probably resided in the fact that the apparatus was not made just as it was calculated, and considering the limitations of the mechanic arts and the variableness of materials, this always comes between the mathematician and the expression of his results in wood, iron, and canvas, or whatever is employed in construction. In most things the variation permissible from plans and calculations is not fatal to utility, and in any other form of flying machine than a balloon the least margin of variation permissible in exact mechanics is probably much too wide to warrant the ex-

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