

the situation. These discoveries indicate that the pitcher-leaved type may be an older form than I had supposed, and that it may have a rather wide distribution. As the peculiar form of the leaflets is readily observed, especially on the young trees, the fact that the occurrence of pitchers in this species has never been published except by myself, and in relation to the trees at Cold Spring Harbor, would seem to indicate that this form probably does not occur in any considerable abundance over extensive areas.

In order to work out their probable evolutionary history, it is necessary to have more complete information regarding the present distribution of these pitcher-leaved ash trees. The reader is requested to assist in securing this information during the present spring and summer, by carefully examining as many young ash trees as may be accessible to him, and reporting the result to the undersigned, giving approximately the extent of area covered by the observations, and the number of *normal* ash trees observed, as well as the number of pitcher-leaved trees—if any of the latter should be discovered. A report is just as desirable in case only normal trees are found as if pitched specimens are found. All communications should be addressed to

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"KEEP YOUR EYE ON THE BALL"

EVIDENTLY my last letter to SCIENCE¹ was not very clear and convincing, for Mr. Patterson² in a recent number insists on making the inertia-reaction of an accelerated body act upon the body itself and thus oppose the accelerating force. To him the term "unbalanced force" means "*a force opposed only by inertia-reaction.*"

In avoiding confusion as to the part played by this force of reaction in any case, I have found it useful to adopt a motto from the royal

¹"Can a Body Exert a Force upon Itself?" SCIENCE, Vol. XLIV., p. 747, 1916.

²"When Is a Force Not a Force?" Andrew H. Patterson, SCIENCE, Vol. XLV., p. 259, 1917.

game of golf—"Keep your eye on the ball." When a ball is swung on the end of a cord, the centripetal force exerted by the stretched cord *on the ball* is unbalanced and produces the centripetal acceleration of the ball. There is the whole story as far as the ball is concerned. The inertia reaction of the ball acts *upon the cord* and through the cord acts *upon the hand*. The law of motion states that the rate of change of momentum of any body is at each instant proportional to the resultant of all the forces acting upon that body. In applying the law to a given body *A*, keep your eye on *A* and consider only the forces acting upon *A*. Among these forces, the inertia-reaction of *A* is never to be included since it always acts upon some other body or bodies.

Mr. Patterson would have us believe that inertia-reaction and friction are not full-fledged forces in the single definite sense implied in the laws of motion. He says neither can produce positive acceleration. Let us see if this is true.

Consider the experiment in which two masses, connected together by a string and free to slide along a horizontal rod, are rotated about a vertical axis. If the distances from the axis are in the right ratio, the masses will rotate without sliding, the inertia-reaction of each mass accelerating the other.

Then take the case of a passenger leaning forward as he stands on a starting train. The forces acting *on him* are his weight, the upward elastic reaction of the floor which balances his weight, and friction. He is being accelerated, and friction is doing it.

Even though some forces are always pulls, others always pushes, and others neither, we need not differentiate between them since each tends to produce acceleration in a certain direction.

Let us agree, then, that a body can not exert a force upon itself; that all forces are similar in their effects; and that in applying the laws of motion to any body, care should be taken to consider only the forces acting upon it.

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