the fact that the so-called 'centrifugal' and 'centripetal' forces acting upon the particle are equal and oppositely directed." I am afraid the reviewer has overlooked the fact that a particle is in static equilibrium when and only when the sum of the forces due to other material bodies acting upon the particle equals zero. When this condition is not satisfied the particle is accelerated and by virtue of the acceleration the kinetic reaction comes into play. This kinetic reaction is equal and opposite to the resultant of the forces due to the material bodies. If it were not for the kinetic reaction a finite force would have given a body an infinite velocity in a finite time.

The kinetic reaction is of the same nature as a force and might be called a force, but that would tend to confound the cause with the effect. It would further necessitate changing the statement of the conditions of equilibrium as well as of motion. It was in order to keep the old concept of force as an action which causes acceleration and to distinguish between cause and effect that I refrained from applying the term force to kinetic reactions.

The concept of kinetic reaction is not new. It has been known to other authors of textbooks of mechanic as *centrifugal force, inertia force,* or *inertia reaction.* The thing that is new about kinetic reaction in my book is the full recognition it receives and the clear cut treatment which differentiates it from accelerating forces. I have preferred the name kinetic reaction to inertia reaction because it is just as much an acceleration-reaction as an inertia-reaction.

I claim that the point of view which I have adopted in my book has important philosophical and pedagogical advantages over the common point of view. The former has enabled me to differentiate between purely geometrical laws and dynamical principles, between kinematical relations and dynamical equations, between what is fundamental and what is derived in mechanics. I have postulated a single dynamical principle which is not only simple and sound, but is correlated with the equally fundamental principles of electrodynamics. Upon this single principle I have based the entire subject, deriving from it all the other dynamical laws and principles used in elementary mechanics, such as Newton's three laws of motion, the principles of the conservation of energy, of linear momentum and of angular momentum.

Before closing this communication I would like to call the attention of teachers of mechanics to the following principle which I have introduced in the second edition of my book and have called it the *angular action principle.*

The vector sum of all the external angular action to which a system of particles or any part of it is subject at any instant vanishes:

$$\Sigma \mathbf{A}_a = 0,$$

or

$$\Sigma(\mathbf{G} + \mathfrak{q}_a) = 0,$$

where **G** denotes the moment of force about a given axis and $\mathfrak{q}_a$ denotes the moment of the kinetic reaction of a particle about the same axis, the latter I have called the *angular kinetic reaction.* This principle, which is directly applicable to rotating systems, is equivalent to and derived from the action principle.

It can be easily shown from the angular action principle that the torque equation

$$G = I \frac{d\omega}{dt}$$

holds good only when the center of mass of the moving system remains at a constant distance from the axis of rotation, a point which has eluded most authors of textbooks of mechanics.

In conclusion I would state that the two action principles are simple statements of the following two sets of equations used in general dynamics.

$$\Sigma(X - m\ddot{x}) = 0,$$
$$\Sigma(Y - m\ddot{y}) = 0,$$
$$\Sigma(Z - m\ddot{z}) = 0,$$
$$\Sigma[y(Z - m\ddot{z}) - z(Y - m\ddot{y})] = 0,$$
$$\Sigma[z(X - m\ddot{x}) - x(Z - m\ddot{z})] = 0,$$
$$\Sigma[x(Y - m\ddot{y}) - y(X - m\ddot{x})] = 0.$$

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THE SYNCHRONIC BEHAVIOR OF PHALANGIDÆ

PROFESSOR H. H. NEWMAN'S note in a recent number of SCIENCE reminds me that in 1901 I made precisely the same observations on the behavior of colonies of the same species of harvestmen (Phalangidæ) in the neighborhood of Austin, Texas. These colonies are not uncommon, nesting in masses on the lower surfaces of overhanging rocks along the canyons of the Colorado River and its tributaries and in the Edwards Plateau region. The colony described by Newman was unusually large, as I do not recall seeing any that were much more than a foot or a foot and a half in diameter and comprising, perhaps, between two and three hundred individuals. The rhythmic, simultaneous, up and down movement of the creatures on their long sensitive legs, when disturbed, is very striking. Merely approaching the spot where the Phalangids are congregated is sufficient to set the whole assemblage vibrating. The stimulus in this case is probably the air-current produced by the sudden approach of the observer and is probably propagated, as Newman suggests, by contact among the interlaced legs. In many cases of synchronic behavior, however, other stimuli must be assumed. In fireflies the initiation of the simultaneous flashes must be due to optic stimuli, as it is in people endeavoring to keep in step with one another, but the continuation of the established rhythm would seem to depend on a kind of "Einfühlung." Such is undoubtedly the impression produced on one who witnesses the rapid wheeling movements of a herd of prong-horned antelopes on our western plains or the flight of certain birds. Some years ago I observed that pelicans flying in single file over the Bay of Panama exhibited a very pronounced synchronism in the beat of their wings. In this case I was led to assume that after the members of a flock had established the synchronism, probably by visual stimuli, it was kept up by a fine sense of rhythm on the part of each individual.

W. M. Wheeler

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MORE COMPLETE TITLES

To the Editor of Science: When the student of the structure or the functions of animals needs to consult the literature dealing with any form on which he has worked, he meets at the outset with the difficulty that a large number of papers to which he turns fail to show in their titles the names of the animals that were used.

In view of this familiar, but none the less unfortunate, state of affairs, I wish to inquire through your columns whether there is any valid objection to the suggestion that authors in some way incorporate in their titles the names of the animals used for their investigations.

In some cases common names would answer, but more often the binomial Latin form would be required. In the case of little known forms, and especially in the case of insects, it would be of great help if the family or order were also given.

Should there be no serious obstacle to the step here suggested, the improvement could easily be inaugurated by the concerted action of the editorial boards of our several biological journals and those heads of departments and bureaus through whose hands forthcoming manuscripts naturally pass.

Henry H. Donaldson

The Wistar Institute,
Philadelphia, Pa.,
February 3, 1917

SCIENTIFIC BOOKS

Milk and Its Hygienic Relations. By Janet E. Lane-Claypon, M.D., D.Sc. Longmans, Green & Co. 1916.

This admirable book has been published under the direction of the Medical Research Committee (National Health Insurance, England). The chief aim of the author "is to present a survey of the existing knowledge upon such aspects of the milk question as hitherto has been inaccessible or difficult to obtain by most of those desiring it."

The scope of the book includes a consideration of the composition, "biological properties," and cellular content of milk; the nutritive value of raw, boiled and dried milk; the presence of organisms liable to cause disease, and milk-borne epidemics; the sanitary production of milk, types of bacteria, methods of