fully the following explanation given in the accompanying text:

"Let us regard the cat as made up of a fore part and a hind part, whose moments of inertia I_1, I_2 are equal when the legs are fully extended at right angles to the body. The photographs given in Plate II. show that it first contracts its fore legs (thereby making I_1 less than I_2) and then turns its fore part round. This latter action necessitates the hind part being turned in the opposite direction (since the total angular momentum about the axis is zero) but to a less extent, since I_2 is greater than I_1. The animal then contracts its hind legs, extends its forelegs, and gives its hind part a turn. This necessitates the fore part being turned in the reverse direction but, again, to a less extent, since I_1 is now greater than I_2. It will thus be seen that by continued action of this kind the cat can turn itself through any required angle, though at no time has it any angular momentum about its 'axis.'"

The explanation offered by Professor Hayford, although a possible one, accordingly does not agree with the actual performance of a cat, as observed by photography.

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UNIVERSITY OF FLORIDA,
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SCIENTIFIC BOOKS

The Wilderness of the Upper Yukon: A Hunter's Explorations for Wild Sheep in Sub-Arctic Mountains. By CHARLES SHELDON. New York, Charles Scribner's Sons. 1911. 8vo. Pp. xxi + 354; 4 colored and 46 half-tone plates; 4 maps, one in colors.

The distribution and relationships of the mountain sheep of Canada and Alaska present one of the most interesting and puzzling problems in North American mammalogy. For the purpose of obtaining more definite information on this subject Mr. Sheldon, a hunter-naturalist of well-known qualifications for such a task, spent the seasons of 1904 and 1905 in the Northern Rockies, exploring the Ogilvie, the Selwyn and Plateau mountains and the Watson River country in 1904, and the Pelly, Rose and Glenlyon mountains in 1905. As a narrative of exploration in practically new fields, the book is an important contribution to our knowledge of the physical conditions and natural history of the region traversed, aside from its bearing upon the special quest for which these journeys were undertaken. Its excellent literary form, its abundant and admirable illustrations and the author's enthusiasm and sympathy with his surroundings, add a value and a charm to his pages unusual in books of hunting adventure. Maps are given of the districts traversed, excellent half-tones illustrate scenic features and there are four colored plates from drawings by Carl Rungius of sheep and other big game.

The sheep of northern Canada and Alaska are quite different from the well-known bighorn of the Rocky Mountains of southern Canada, the United States and northern Mexico. The first northern form to become scientifically known was the *Ovis dalli* described by E. W. Nelson in 1884 from specimens collected in the upper Yukon region of Alaska. This sheep is pure white at all seasons except for adventitious staining from soil or vegetation; it is smaller and has less massive horns than the various forms of the Rocky Mountain bighorn.

In 1897 a black form was described as *Ovis stonei* from specimens obtained in the Cheonee Mountains south of the Stikine River in northern British Columbia. Although the Alaska form is pure white, and the other so dark colored as to be known as the black sheep, the structural differences that characterize them are slight and inconstant.

A few years later (in 1901) a sheep intermediate in coloration between the white and black sheep was described as *Ovis fannini,* based on specimens collected near Dawson City. As the sheep of this general region became better known it was found that the sheep of the *fannini* type were very unstable in respect to coloration and were apparently intergrades between the white form of Alaska, the Yukon and Northwest territories and the black form of northern British Columbia.

This was about the sum of our knowledge of these sheep when Mr. Sheldon set out in 1904 and 1905 to make a special study of the sheep question of the northern Rockies, and to trace out their geographical and physical relationships. Chapter XX. of this book gives a summary of the results of his two seasons' work, and is illustrated by a map in colors showing the known distribution of the white and black sheep of Canada and Alaska, their areas of intergradation and the phases characteristic of special districts. Facing the map are half-tone figures of nine stages of color variation, with explanatory text. The subject is thus graphically and clearly illustrated by the distribution map, the facing explanatory text and shaded figures. The area embraced extends from about latitude 55° to latitude 70°. In Alaska, from the Arctic coast south to latitude 60°, and in Yukon Territory and northeastward in the Mackenzie Mountains to about latitude 62° (generally speaking), the sheep are pure white, except in the Tanana Hills south of the Yukon River, where the white coat is varied with a few black hairs and slight indications of the color pattern of the *fannini* type; in British Columbia south of the Stikine River the sheep are uniformly black; but over an intervening region of from approximately six hundred and fifty miles north and south and about one hundred and fifty to two hundred miles east and west, "there is no area in which the color of the sheep is uniform."

Mr. Sheldon indicates on his map five areas (*a, b, c, d, e*) where the sheep are either pure white (*a*), or black (*e*), or are of intermediate or mixed shades (*b, c, d*); the *b* grade is nearly white, the *d* grade nearly black, *c* being the middle phase or the *fannini* type, which is intermediate geographically as well as in color.

The facts of intergradation are thus forcibly and clearly presented—an intergradation continuous and gradual from one extreme phase to the other through a vast expanse of country. The cause of this extensive and gradual merging of these two widely diverse color types of sheep is not so easily demonstrable. Has it resulted from interbreeding or is it due to environment? Mr. Sheldon favors the former hypothesis, but admits the possibility of its having been "produced by subtle and indeterminate changes of environment to a much greater extent than the facts seem to me [him] to warrant."

The large size of these animals and the striking color differences between the extreme phases that are thus shown to intergrade render this an impressive instance of intergradation, but parallel cases, though less striking, in other animals usually seem explainable satisfactorily, and in many instances beyond question, on the hypothesis of the action of diverse conditions of environment. But whatever conclusion may finally be reached as to the cause, great credit is due Mr. Sheldon for his contribution of facts through a successful reconnoissance of the almost inaccessible haunts of the sheep in the Northern Rockies where lay the key to the problem—an undertaking few would have the hardihood to project or the endurance and persistence to accomplish. Besides the facts of variation and range already outlined, his contribution to the life-history of these animals is of noteworthy importance, while the wide range of individual variation among members of the same herd, not only as regards coloration, but in respect to size, shape and curvature of the horns is noted in detail. He has also presented to the National Museum the large series of specimens of sheep obtained by him on his expeditions which go far to substantiate the facts of intergradation recorded and illustrated in his book, which may be read with equal interest by the naturalist, the big game hunter and the general reader.

J. A. Allen

Principia Mathematica. By Alfred North Whitehead, Sc.D., F.R.S., Fellow and Lecturer of Trinity College, Cambridge, and Bertrand Russell, M.A., F.R.S., Lecturer and late Fellow of Trinity College, Cambridge. Cambridge University Press. 1910. Vol. I., pp. xiii + 666.