tainment and determination of the northern terminus of Greenland, and everything will be subservient to that.

"I shall be accompanied by five young men, and the following particulars about the members of the party may be of interest. John M. Verhoeff of Louisville, Ky., is a young man of twenty-five, educated in an Eastern university, a mineralogist, and, though somewhat below the average in stature, has a magnificent lung development and a record for endurance and cross-country walking. Mr. Verhoeff has contributed generously to the expenses of the expedition. Dr. Frederick A. Cook, the surgeon of the expedition, is an able young physician and surgeon, a native of New York State, a graduate of the College of Physicians and Surgeons and of the University of the City of New York, and has been in practice in New York City for several years. He is twenty-six years old, strongly built, is five feet nine inches in height, weighs a hundred and fifty pounds, and has a lung expansion of five inches. Langdon Gibson of Flushing, L.I., is a stalwart young fellow of twenty-six, and one of the many active and enthusiastic members of the American Ornithologists' Union. He was one of the Brown-Stanton party in the memorable Colorado Cañon survey of 1889–90, and knows what arduous work is. He is six feet tall, weighs a hundred and seventy-eight pounds, and has an exceptionally fine lung development. Eivind Astrüp of Christiania, Norway, is a stalwart young fellow, who has but recently come to this country. He is the son of the commander of the Royal Civil Guard of Christiania, a first-class graduate of the Christiana Commercial College, and a winner of numerous prizes in athletic sports, especially ski-running. He is five feet seven inches in height, weighs a hundred and sixty-seven pounds, and has a lung expansion of four inches. Matthew Henson is a hardy young colored man, a native of Virginia, twenty-three years old. His intelligence and faithfulness, combined with more than average pluck and endurance, as shown during several years that he has been with me through varying experiences, part of the time in Nicaraguan jungles, lead me to regard him as a valuable member of the party. The members of my party are all young, and, in addition to possessing first-class physique and perfect health, they are men of education and attainments. I believe this to be the type of man best fitted to endure with minimum effect the ordeal of the Arctic winter, and to effectively execute a two or three months' dash on sledges, where intelligent will-power, elasticity, and enthusiasm are at a premium over the stolid endurance of muscles hardened by years of work. Mrs. Peary will accompany the party to Whale Sound. Possessed of youth, health, energy, and enthusiastic interest in the work, she sees no reason why she cannot endure conditions and environment similar to those in which Danish wives in Greenland pass years of their life. In this opinion I fully concur, and believe that in many ways her presence and assistance will contribute to the valuable results of the expedition, as they have been invaluable to me in the preparation.

"The food supply of the party is not materially different from that of the later Arctic expeditions. Tea, coffee, sugar, and milk are in quantity sufficient to last two and a half years; other supplies for a year and a half. But little meat will be taken, outside of the pemmican for the sledge journey, as there is an abundance of reindeer, ptarmigan, Arctic hares, foxes, ducks, loons, seals, and walrus in and about Whale Sound. Special items of interest, principally for the sledge journey, are as follows: tea, compressed into quarter-pound cakes, partially divided, like chocolate, into quarter-ounce squares; compressed pea soup tablets, a German preparation; beef-meal pemmican and beef-meal and cocoa tablets, prepared expressly for the expedition; evaporated cabbage, potatoes, onions, turnips, carrots, and apples.

"Next to the food supply comes the house. This will be a light structure twelve by twenty feet (inside measurement) with double walls inclosing a ten-inch air space. There will be a triangular air space between the ceiling of the rooms and the roof sheathing, and the rooms will have three layers of tarred paper between them and the exterior air. The walls of the rooms will be hung at first with blankets, and later probably with skins. The house will be surrounded by a wall of stones, turf, and snow as high as the eaves, leaving a narrow passage entirely around the house, and during the winter this space and the roof of the house itself will covered in with a thick layer of snow.

"The expedition will have two whale boats and several sledges, including the two made and used by me in Greenland in 1886. The new ones, though of the same type, will be lighter than the old ones. Each member of the party will have Indian snowshoes and Norwegian "ski" moccasins and rubber ice creepers."

LETTERS TO THE EDITOR.

**** *Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The editor will be glad to publish any queries consonant with the character of the journal.

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Immortality in the Light of Modern Dynamics.

I WOULD like, with your permission, to take issue with the writer of the article under the above title published in *Science* of May 29.

The eleventh paragraph, speaking of the reader of the journal of the Institute having "read the same lines" therein, "an endless number of times," "billions of years ago," naturally suggests doubts of his seriousness; and if I am mistaken in the assumption that a gentleman of his great attainments and high position is surely in earnest while thus treating on scientific subjects before that learned body, the Franklin Institute, and that therefore the paper could not have been intended as a burlesque upon modern science, it must be set down to my "simplicity."

In his illustration by the falling of dice, he truly says that the number of dice used has nothing to do with the truth of the proposition that they must, some time, again present — and with a certain average frequency — the same combination of numbers. Evidently, however, he quite overlooks one element of the case, which omission — a most astonishing one — utterly vitiates his illustration and reasoning thereon.

The matter overlooked is the fact that each one of the dice is limited to a certain finite number of exact positions, in one of which it must fall; and after it has, once or more, fallen in each of these, all subsequent falls must necessarily be exact repetitions of some of these, hence the possible number of combinations is also limited, and then must come repetitions.

Let us suppose, however, that the dice, instead of cubes, be perfect spheres, and thrown upon a perfect plane. The number of positions in which any one could come to rest would be infinite, and it is scarcely supposable that it would ever, in an eternity of throws, take absolutely the same position a second time. Now, such is the condition of the atoms spoken of, except that in their case it is more complex, as their are more conditions.

Every particular combination produced must, of course, be simply the resultant of the positions and motions of the atoms. The possible positions and also the possible directions of motion, as well as velocities, are infinite in number, hence the chances are infinity to one against the same combination again occurring even between any two of them, — yea, an infinity of infinities.

Moreover, when the same concurrence of the atoms should occur and reconstruct the same identical form, — of Cæsar, for example, — an essential pre-requisite is, that all influences must be the same as before, hence all surrounding conditions, near or remote, must be identical with those of the former epoch; i.e., the universe must be throughout exactly as before: there are no influences except position and motion, hence every identical atom must be, at the one instant, in the same one of the infinitively various positions, moving at the same one of the infinite different velocities, and in the same one of the infinitely different directions, including the infinite various vibrations, as before, — all this while it is incredible that any one of them will ever move in absolutely the same direction a second time, or that any one of the conditions requisite to the repetition of a former combination will ever exist.

An infinitesimal difference from the former time in the case of any one atom in the universe in any particular at that instant

must affect the next contiguous one, and so on *ad infinitum*, and change the result.

So, taking his illustration of the action of sand grains, not one of them is bound, nor are they likely ever, in an eternity of shaking, to take again the identical position that they have once assumed, because there is not supposed or suggested any cause guiding them to it. There is an infinite number of other positions equally possible and likely,—an infinite number can never be exhausted. And, further, sand grains or atoms have not, like the dice, one fixed plane on which they must rest: the number of planes which they may occupy is unlimited.

In his dice illustration he limited the repetition to the one circumstance of numbers uppermost; whereas, had he taken into account lateral position and distance apart,—all of which, and much more, he must do before he is fully prepared for the rehabilitation of Julius Cæsar in his ancient glory,—his reasoning would not apply, even to the dice.

The former exact position or motion of an atom can have no influence to cause it to be repeated, hence all — conceivable or inconceivable — combinations must be equally possible, equally probable, equally certain; where then is the suggested improbability that the molecules constituting the author's body "once filled a bung-hole," or, indeed, not once only, but an infinite number of times? Some atoms had to fill it, why not those? This point needs elucidation, or we must hold that, according to his "iron logic of modern dynamics,"— which he seems for the moment to have lost sight of,— these very atoms must take their turn at the bung-hole from time to time, as well as the rest.

The great Solomon, the wisest man that ever lived or ever shall live, erred for once in his oft-quoted doctrine, "There is nothing new under the sun," inasmuch as he should have said, "There is nothing *old* under the sun;" i.e., no combination of things, circumstances, or conditions which ever — precisely — occurred before, or which is absolutely identical with those at any preceding epoch. "The thing that hath been is [not exactly] that which shall be."

Hence it plainly appears that the recurrence of the same entire range of conditions, which, to the minutest particular and throughout the universe, is requisite to the reproduction of former structures and actions, is as certain never to take place, as is the same epoch, the identical moment of time, certain never to return.

W. H. PRATT.

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