

ordinary game. Let us place them in a little box, shake them, and throw them on the table. We will assume that they had fallen so that each cube exhibited the number three on its upper face; of course, a rare chance. Now it can be mathematically shown after how many throws those six numbers are likely to reappear according to the law of chance. It is possible that they may turn up already with the next throw; on the other hand, we may have to cast those dice ten thousand times. Both cases are improbable: the probability lies in a certain number. If, instead of six dice, we were to take seven, the critical number is, of course, so much further removed, viz: it would be necessary to throw oftener to get the seven threes, and so the number of casts increases with every additional cube, till we finally obtain enormous figures. But no matter how many dice, the threes must turn up, if we can throw them long enough, and if, in the case of a thousand dice, it were to take a million years, the threes must appear and reappear again and again after proportionate intervals.

Supposing now, that, instead of dice, we were to take a glass filled with sand. There are, let us assume, twenty thousand sand grains in the glass. Each particular grain occupies a certain position, which is bound to differ from that of all the rest of the sand grains: this the reader will doubtless admit. We shake the glass; the positions are altered, the order of arrangement is disturbed. We shake it again; the sand grains are now in a totally different position. We continue shaking the glass, and the time must come when each individual grain again occupies the exact position which it occupied when we originally started. It is a mathematical necessity, which all will admit who know anything of the calculus of permutations. The twenty thousand sand grains may be looked upon as so many dice, which are bound to fall precisely as they once fell if we can throw them sufficiently often.

Now, I have strong grounds for assuming that my body is composed of atoms, or groups of atoms, of a limited number of elementary substances, or of one elementary substance, if all matter has been evolved from one primary element. The number of these atoms may be ever so great, it has nothing whatever to do with the inevitable result. I know also that all other bodies are composed of such atoms, or groups of atoms (molecules); not only those of the human species, animals, and plants, but of inorganic substances, rocks, metals, fluids, gases; in short, of every thing which exists in, upon, or above the ground in the atmosphere. I know, furthermore, that the atoms of even the hardest and seemingly most enduring substances, such as agate and diamond, are in a state of continual vibration; that nothing can permanently retain its form; that the entire universe always has been, is now, and always will be, in a state of metaphorphosis or continual change.

The time must arrive when the atoms or molecules which are now united in my body, after countless transformations and wanderings through all kinds of bodies, substances, or intermediary stages, will once more unite in the same manner; in other words, the time will arrive when my life, like that of every other individual, will repeat itself. Yes, repeat itself, and not merely once, but an infinite number of times.

(And more than this, if one of my readers should imagine that the atoms or molecules which now constitute his body, are thus associated for the first time, I can only admire his simplicity. There is nothing new under the sun. Those molecules were united in this manner before, and before this again, and 100,000,000 times previously, as far as our imagination can carry us back into the abysmal night of the æons of the past. In other words, each of my readers has been, ages ago, what he is now, has lived and gone through all this before, has felt and experienced what he now feels and experiences, down to the minutest details, has opened his *Journal of the Franklin Institute* billions of years ago and read the same lines; not once, but an endless number of times.) The recollection, of course, is lost. Life and mind itself, consciousness, or "soul," is only a product of matter, and if the same substances reunite in the same manner, the same phenomena must inevitably recur.

Let the molecules which now constitute my body undergo ever so many metamorphoses, let them even — which, of course, is very improbable — once fill a bung-hole, let them be scattered

about in all manner of forms and conditions, in close contact or millions of miles apart; they must come together again, may the thought please or distress me, — this is the iron logic of modern dynamics.

#### A JOURNEY IN COSTA RICA.

At the February meeting of the Geographical Society of Paris (reported in the Proceedings of the Royal Geographical Society, London) a letter was read from M. H. Pittier, head of the Physico-Geographical Institute of Costa Rica. His route lay through country not previously explored from a scientific point of view. At a distance of several leagues from the capital, the traveller entered the region of oaks, which he hardly quitted for a whole week. The whole of the district known under the name of Candelaria, which, at the time of CErsted's visit, was well wooded and rich in interesting plants, has become denuded of vegetation through the carelessness of the inhabitants, and is to-day partly covered with a poor kind of turf, over which are scattered clumps of the fragrant bushes of the "tuete" (*Vernonia brachiata*). Beyond the Rio Tarrazu the character of the country changes, and the road ascends in a zigzag line the mountain slopes, covered with forests of virgin oaks. On the summit of the Cordillera the "Paramo del Abejónal," the vast prairie which occupies the ridge of the mountain is crossed, and then a rapid descent was made to San Marcos. From the latter place to the valley of the Rio General is a journey of five days, across the great mountain of Buena Vista, the geographical importance of which has, according to M. Pittier, been overlooked, owing to insufficient exploration. Although inferior in height to the peaks of Irazu and Turrialba, Buena Vista presents more sudden changes of climate and a greater variety of vegetation. The summits are almost continuously swept by a keen, strong wind, which condenses thick mists. Sleet falls frequently, and a white frost forms when the nights are clear. The immense forests, which clothe its flanks up to a great altitude, are formed almost exclusively of oaks, among which the most frequent varieties are the *Weinmannia glabra* and the *Drymis Winteri*. The vegetation of the upper region, above the forests, is alpine in character, but the bamboos were found growing beside representatives of an evidently northern flora. At one point, clearly defined formations of columnar basalt were noted. This, with other indications, led the traveller to the conclusion that the whole of the Cerro de Buena Vista is of eruptive origin, although no traces of former volcanoes were discovered. The mountain is important from a hydrographical point of view. The head waters of the Rio Reventazin occupy the greater part of its northern slope; on the west it feeds the Rios Parrita Grande, Naranjo, Savegre, and Baru; while the various branches of the Rio General take their origin from its southern flank. M. Pittier intended to cross the immense forest-covered plains extending on the left bank of the Rio General as far as the Indian villages of Terrata and Boruca, and to return to San José at the end of February. He states that the maps of all this part of Costa Rica are very faulty.

#### HIGH WINDS AND BAROMETRIC PRESSURE.

THE relation of high winds to barometric pressure, from observations carried out at the Ben Nevis Observatory, was the subject of a paper from Dr. Alexander Buchan, at a meeting of the Royal Society of Edinburgh on March 2, 1891, an abstract of which is given in the *Scottish Geographical Magazine* for May. This was a question, Dr. Buchan said, which had been much discussed in recent years, — some meteorologists maintaining that the influence of high winds was to depress the barometer, others that it was to raise the barometer, and several others, again, that it had practically no effect whatever. In the discussion of the Ben Nevis observations, particularly from the time that hourly observations began to be obtained from the low-level observatory at Fort William, in July last, the first question that appeared to him calling for thorough investigation was this question of the relation of the winds to the readings of the barometer, inasmuch as, till this relation be approximately determined, the proper discussion of