

the exploration of the earth's apex, thus: "It may be shown," says he, "that no such extent of unknown area in any part of the world has ever yet failed to yield results of practical as well as purely scientific value; and it may be safely urged that, as the area exists, which is mathematically certain, it is impossible that its examination can fail to add largely to the sum of human knowledge."

In plain terms, the discovery of the pole has reduced itself to a matter in which the curiosity of mankind to know what exists at this *ultima thule* of the globe, a curiosity augmented by repeated baffling, is probably more the underlying cause of attempts to solve the problem than even the thirst for abstract knowledge. If there had been, or could be, any direct gain by reaching the open Polar Sea, we have little doubt but that it would have been penetrated long ago; for the arctic whalers' extremely powerful vessels, with proportionately strong engines, make their way through the ice with ease to regions, and spend months in localities, which the earlier explorers attained only by immense toil and hardships. If the masters of these ships had found out that more blubber could be got in the Polar Sea than elsewhere, the passage would have been made, and the world would probably have remained in ignorance of the fact, until some one had noted with astonishment the figures denoting latitude, which the captain would, quite as a matter of course, have jotted down in his log.

Curiosity, coupled with a patriotic desire to outdo the previous endeavors of other nations, is the motive of popular attention to the North Pole just at present. The problem once solved, the attainment of the South Pole will be as eagerly sought after; and there will be scores of attempts to penetrate the barriers of a region so vast that the moon might easily fall into it without affecting, by the impact alone, any portion of the world now known to man.

THE HYDROLOGY OF SOUTH AFRICA.

Mr. Froude the historian turned statesman, came back last winter from his self-appointed mission to South Africa big with the belief that he had seen the beginnings of an Anglo-African empire destined to rival our United States in power and prosperity; and he has just sailed thitherward again, bearing an official commission for the advancement of his scheme of confederation, the one thing needful, he thinks, to ensure the speedy development of the colonies of South Africa into the empire of his dreams.

There is much that is attractive in the thought that the continent so long given over to barbarism is about to be won over to civilization by British pluck and energy: nevertheless the prospect of its successful accomplishment is not nearly so bright as Mr. Froude imagines. Something more than men and money, however plucky and plentiful, is requisite for the up-building of an empire. First of all there must be a favorable physical basis, a fertile country, and a genial climate; and if any climatic changes are going on, they must be such as to make the country increasingly productive and habitable.

Unfortunately these conditions are not well met in South Africa. The drift of its climatic changes (and they are enormous) is in the wrong direction, and the operations of its inhabitants are now, and have long been, of a nature to hasten the natural course of climatic derangement. Already vast areas, recently well wooded, well watered, and of boundless fertility, have been converted into barren wastes, alternately parched by drought, ravaged by fire, and torn with torrents of untimely rain; and unless the settlers make a radical change in their mode of procedure in clearing the country, its conquest is much more likely to result in a great desert than a great nation.

By those who have followed the travels of Livingston and others through South Central Africa, the great interior basin of the continent will be remembered as a vast region of swamp, lakes, broad rivers, and trackless forests. To the south lies the basin more thoroughly drained by the river Zambesi, described by travelers as a region just emerging from a condition like that obtaining further north. The rivers have worn their channels deeper through the enclosing rim of the basin, the swamps are turning into grassy plains, the lakes to swamps or to salt-encrusted "pans."

Still further to the south is the southernmost basin of the continent, enclosed by mountains running parallel to the coast. The central part consists chiefly of rolling prairies with few springs, fewer permanent rivers, and forests gradually diminishing to a final destruction which cannot be long delayed. As a rule rain is infrequent, droughts of common occurrence, and irrigation absolutely necessary for the raising of European grains. Yet within the memory of men still living this has been a country of lakes and rivers, abundant rain, heavy timber, and plentiful pasturage. Rivers, now dry the most of the year, then ran with full banks and swarmed with hippopotami and other water-loving animals. And the whole country bears abundant evidence that it is but a little while, geologically speaking, since it was the counterpart of the lake regions traversed by Livingston in the central basin of the continent.

When Dr. Moffat first entered the country as a missionary, in 1821, the natives had not forgotten the floods of ancient times, the incessant showers which covered the very rocks with verdure, and the giant trees and forests which flourished on hills and plains now barren and desolate. They boasted of rivers which ran impassable torrents in the days of their forefathers, while the lowing herds walked to their necks in grass; and the ancient river beds, shore lines, and vestiges of enormous trees bore witness that their stories were not exaggerations. Since the missionary work began, streams, which then furnished drink for thousands of cattle

and water for the irrigation of miles of cornfields and gardens, are now absolutely dry.

Farther west the desiccation of the country is much more extensive and severe, forming the great Kalahari desert, the wastes of Namagualand, and the barren wilds of Bushmanland. Here the drying up of the country has all but reached its limit in degree, though not in area, for the desert steadily encroaches on the habitable land. To some extent, man is not to blame for the climatic changes thus going on. The natural wearing down of the outlets of the basin has drawn off the waters of the lakes, emptied the swamps, and converted the country into something less like a gigantic sponge than it originally was. But the most disastrous effects have been produced by human agency, by the destruction of the country's arborescent and herbaceous clothing by fire.

When Vasco de Gama first explored the coast four hundred years ago, he called the country Land of Smoke. How long the burning had been going on it is impossible to tell: it has certainly been going on ever since. The dominant native races in South Africa are comparatively recent invaders, and wherever they have gone the forests have disappeared. They are "a nation of levelers," says Mr. James Fox Wilson, who has given the matter much careful study on the spot, and "they are the prime cause of the advancing drought."

The practices of the Bechuanas are especially fatal to the forest growths. They cut down and burn down everything, regardless of scenery or economy, stripping the country where they settle, then moving on to devastate other regions and prepare the way for the encroachments of the desert. Wild fires, started for the purpose of clearing the open country of the annual growth of tall grass, play no small part in the work of devastation, killing in dry seasons most of the shrubs and young trees that spring up in wet ones. In Namagualand, the same office is performed by the scorching sun, the effect of drought in this case being, as Mr. Wilson points out, an auxiliary cause of drought.

But the spreading of the desert is not confined to the areas beyond the European settlements. There are vast regions, in the basin of the Orange river and in Cape Colony itself, bare of timber and bush, largely in consequence of the pertinacity with which both native and European colonists adhere to the suicidal practice of burning the dry fields in winter that the flocks may find abundant pasturage as soon as spring sets in. In these bare regions, trees are hardly ever to be found, except on the banks of rivers or in high mountain passes, as the fire penetrates into all the ravines where the most luxuriant vegetation is found, and destroys it. The more denuded of trees and brush wood, and the more arid the land becomes, the smaller the rainfall. "The greater the extent of heated surface over which the partially exhausted clouds have to pass, the more rarefied the vapor contained in them necessarily becomes, and the higher the position which the clouds themselves assume in the atmosphere under the influence of the radiating caloric: consequently the smaller the chance of the descent of any rain on the thirsty soil beneath. And the more the short-sighted colonists and ignorant natives burn the grass and timber, the wider the area of heated surface is made, the further the droughty region extends, the smaller become the fountain supplies, and the more attenuated the streams, until they finally evaporate and disappear altogether. Thus the evil advances in an increasing ratio, and, unless checked, must advance, and will finally end in the depopulation and entire abandonment of many spots once thickly peopled, fertile, and productive."

This evil prophecy was spoken ten years ago, before the British Association, and the occurrences of the past decade have only tended to confirm it. The progress of South Africa is plainly toward uninhabitableness. The increasing severity of the droughts, the vast sweep of the forest and field fires, and the sudden and terrible cloud bursts of rain and hail experienced in the settled portions of the colonies are described at length in the work on the "Hydrology of South Africa," prepared by Dr. John Croumbie Brown, formerly colonial botanist at the Cape (and favorably remembered by our readers for his successful championship of Darwinism before the Evangelical Alliance two years ago). In 1869, after a long period of exceptionally dry weather, a tract of country 400 miles long and 150 miles in extreme breadth was swept by fire, destroying fields and forests, farm houses, grain stacks, wild beasts, and domestic animals, and in many instances the families of the settlers.

Smaller yet very extensive fires are of yearly occurrence. The effects of such wholesale denudations of the surface are necessarily widespread and disastrous. The uplands become naked, parched, and slashed with gullies; the lowland springs dry up, the streams fail, and the entire economy of Nature is permanently disturbed. Rains that should be distributed over the entire year fall in a few destructive deluges which wash away the soil and turn the rivers into torrents, roaring sometimes fifty feet above their natural level at high water. Details of a number of such storms are reprinted by Dr. Brown from the colonial newspapers. During one of them in Natal, 27 inches of rain are said to have fallen in two days: the destruction of property was necessarily enormous, even in a sparsely settled region.

A specimen hailstorm is described by a member of the Transvall Geological Expedition. It occurred at Pietermaritzburg, Natal, April 18, 1874. Mixed with the hailstones—which averaged from one and a half to two inches in diameter—were irregular masses of ice from two to four inches in diameter and weighing from four to eight ounces. "On many roofs fully half the tiles were broken, not merely cracked, but very frequently masses went right through into the houses. None have escaped. Fortunately for windows, there was no wind, or the damage would have been much

heavier. Many of the corrugated iron roofs are dented all over and have a pock-marked aspect, while some corrugated iron roofs are completely riddled: the stones went right through as though they had but paper to encounter."

It is proper to bear in mind in this connection that Natal is the garden of South Africa.

During the following November, the newspapers complained of severe and long-continued drought in all the midland districts of Cape Colony. It was followed by a deluge toward the end of the month. Rivers which had been dry for months were suddenly filled with raging torrents, carrying away bridges to the value of \$1,500,000. In one case a bridge, built high enough, it was supposed, for any flood, was forty-five feet under water, and of course utterly destroyed. Several towns were flooded, and not a few lives were lost.

After reciting at length many incidents in connection with this and similar storms, Dr. Brown remarks that it often happens that, within an hour or two after such torrents of rain have been precipitated, the sky is cloudless and serene, and frequently within a month or two all is as arid as before. Yet in such a country, and with a people bent on courses calculated to intensify and perpetuate such climatic evils, Mr. Froude expects to see a great empire grow up!

It is but just to Dr. Brown to say that, while fearlessly recognizing the certain tendency of the climatic changes to make a desert of South Africa, he does not despair of the future of the colonies, provided the colonists cease to do evil and learn to do well. He strenuously urges upon them the one course which will enable them to hold their ground and possibly recover the advantages they have wasted, namely, to put a stop to field and forest burning, and then set to work to restore the forest growths. It is, he admits, a difficult and costly undertaking; but it is absolutely necessary.

SCIENTIFIC AND PRACTICAL INFORMATION.

ORIGINAL MICROSCOPICAL RESEARCHES.

To such of our readers as propose devoting the coming summer vacation to microscopical work, we can suggest the following investigations as offering excellent fields for original research: First, examine the theory suggested by Dr. Bastian as to occasional transformations taking place between the lowest forms of animal and vegetable life. Confine some minute vegetable tissue—if showing protoplasmic circulation, so much the better—in a live box, and watch with care. Notice if, in process of time, nuclei or any other parts should undergo any such transformations. A $\frac{1}{4}$ inch or $\frac{1}{2}$ inch objective is suited for the purpose. There is abundant opportunity for new work in relation to fungi. Cooke's recently published book on that subject should be well studied, and collections made in the field, enough to go over, if possible, the author's ground. The limits of present discovery will soon be recognized, and a line of further progress can readily be mapped out. There is yet plenty to be discovered about the insects. The foot of a fly, for example, its structure, method of use, properties, exudation, etc., would form an excellent subject of study for a long time. The student, if he faithfully perseveres, is pretty certain to hit upon something new. The microscopic changes of the tissues and fluids of the human body, in health and disease, also invite research. This requires vast patience, an excellent instrument, and no small degree of skill; but it offers results which, if gained, will well repay expenditure of time and energy.

MORE JAW WRENCHERS.

"Benzanishydroxamic acid" and "anisidibenzhydroxylamine" are two more chemical absurdities in the way of names recently coined, of course by a German chemist. Cannot somebody invent some rational plan for naming and renaming organic substances that will relieve the science from these polysyllabic nightmares? Suppose the chemists begin by agreeing among themselves to limit the baptismal titles of their discoveries, say to four syllables. Or why not use some symbols which might mean any number of prefixes or suffixes, and thus express the idea without inflicting it on the mind through torture of the jaw?

A MOUTHFUL FOR CIGAR SMOKERS.

The products of the combustion of tobacco, if the combustion were complete, would be carbonic acid, ammonia, and water: in the process of smoking, however, most of the tobacco is distilled rather than burnt, and the products of this distillation are quite numerous and complex. Vohl and Euhlenburg, after burning 150 cigars, recognized with distinctness, in the smoke, cyanhydric acid, sulphuretted hydrogen, certain acids of the fatty acid series, namely, formic, acetic, propionic, butyric, and valerianic: also carbolic acid and creasote, pyridin, picolin, collidin, and other similar alkaloids. They found also ammonia, nitrogen, oxygen, and small quantities of marsh gas and carbonic oxide.

A LIVING RAFT.

The leaves of the gigantic water lily known as the *Victoria Regia*, in the Botanic Garden at Ghent, having attained a remarkably large size, Mr. Van Hulle, the chief gardener, recently undertook to determine their buoyant power. One leaf easily supported a child, and did not sink under a man. Mr. Van Hulle then heaped bricks over its entire area and found that, before the leaf became submerged, a weight of 761 lbs. was floated.

A CENTENNIAL CLERGYMAN.—On the 8th of June last, the Trinity Methodist Episcopal Church, at Jersey City, N. J., held a celebration in honor of the one hundredth birthday of the Rev. Henry Boehm. For seventy years or more he has been a preacher. On the occasion of the celebration, when he rose to address the audience, the clearness of his faculties was observable by all present.