simple, unaffected style. For many centuries China has had the monopoly of supplying the Thibetans with tea, of which they are most extensive consumers. The Lamas of Thibet have the exclusive privilege of retailing this tea, and both they and the Chinese naturally do all in their power to prevent the possibility of any rivalry in the lucrative trade. It was on this account that Mr. Cooper was prevented from completing his intended journey from Shanghai overland to India. In the present work the author describes an attempt which he made to penetrate into Thibet from the Indian side, for the purpose of discovering whether it would not be possible to open up a way for the introduction into that country of the abundant produce of the Assam tea-plantations. He proceeded from Calcutta to Sudiya, on the north-east frontier of Assam, from which, after making all due preparations, he set out on his adventurous journey in the latter part of 1869. Notwithstanding that Mr. Cooper was accompanied by a Khamtee chief, Chowsam—a fine manly fellow—who knew the country well, and was feared and respected by the people through whose country Mr. Cooper had to pass, the latter, amid great hardships, succeeded in penetrating north-eastward along the Brahmapootra, only about 100 miles, when, through the determined opposition of the Thibetan officials, he was compelled to turn back. No doubt Mr. Cooper failed in accomplishing the object on which he had set his heart, but his journey has been the means of giving to the world a book full of interesting information about the peoples and the countries where he sojourned, both in Assam and the districts just beyond its north-eastern frontier. The book contains a great deal of information on the present and past condition of Assam and the Assamese, and much information on the state of the tea-cultivation in that country. Mr. Cooper is particularly observant of men and manners, and most readers will find in his book a great deal that is quite new concerning the small tribes that live along the route by which he attempted, in the interest of commerce, to enter Thibet; his description of the Khamtees is especially interesting. Mr. Cooper does not pretend to give any scientific record of the natural history of the country through which he passed, though he makes occasional observations that may interest naturalists. The following description of the land-leeches which pestered him during his journey, seems to us particularly interesting:—

"Of all the hardships and unpleasant sensations experienced in the Assam jungle none have left a more disagreeable recollection than the attacks of land-leeches. Often, on sitting down, I could count a dozen of these little animals hurrying from all directions to their prey. In length they are about an inch, while their thickness does not exceed that of an ordinary sewing needle. Their mode of progression is curious in the extreme. Fixing one extremity by means of its bell-shaped sucker firmly on a leaf or on the ground, the leech curves itself into an arch, the other end is then advanced till the creature resembles a loop, again to expand into an arch, but the movement is quicker than words can describe it; the rapidity with which they thus progress along is quite startling. As they occasionally rear themselves perpendicularly and sway about from side to side, taking a survey round them in quest of prey, the observer cannot fail to conceive a dread of the bloodthirsty little creatures. They exercised quite a fascination over me. I could never resist watching them whenever I took a seat. Their power of scent was evidently keen. At first they would hold themselves erect, then suddenly, as though they had just discovered my whereabouts, they would throw themselves forward and with quick eager strides make towards my unfortunate body, and it was a long time before I could restrain a shudder at their approach, but use does wonders, and at last I used to flip them off my clothes and hands, Khamtee fashion, with great indifference. There

are several species of leeches in Assam, but I have only come in contact with three kinds: the common brown one, just described; the red, or hill leech, which is larger than the former and of a light red colour, inflicting a venomous, though not dangerous, bite; and the hair-leech, so called by the Khamtees from its great length and extreme tenuity. This last description of leech lies in wait in the grass, and as animals feed it enters the nostrils and fixes itself firmly in the interior, where it takes up permanent quarters, causing the poor beasts great irritation. It seems to inflict itself entirely on animals, which is fortunate, or man would suffer greatly from this scourge of the jungle."

Mr. Cooper has done well in telling the world the story of his travels.

Transactions of the Albany Institute, vol. vii. (Albany, U.S., 1872.)

THIS institution is one of the oldest of its kind in America, having been originally founded upwards of eighty years ago, just after the conclusion of the American War of Independence. At present it is one of the most comprehensive and active of the American societies, its sphere of work embracing all departments of literature and science. In an eloquent annual address, which is the first paper in this volume, Orlando Meads, one of the oldest members of the Institute, sketches its history, and gives reminiscences of some of the most eminent men who have been connected with the Society, including several who have left their mark on the country. A characteristic feature of this volume is the reports of what has been done during the year, both in America and Europe, in the various divisions of science and literature, the institution being divided into three departments—Physical Sciences and the Arts, Natural History, and History and General Literature, and these again into a number of classes. Thus we have in the present volume, reports on botany, zoology, chemistry, and general literature. Of the papers in this volume we may notice one on Nitro-glycerine, as used in the construction of the Hoosac Tunnel, by Prof. G. M. Mowbray. The author traces the history of the dangerous article, gives an account of his own investigations regarding it, and describes the method in which it was used in boring the Hoosac tunnel.—On certain new Phenomena in Chemistry, by Verplanck Colvin, describes some very remarkable experiments in amalgamation made by the author. From Newton to Kirchhoff, by Dr. L. C. Cooley, traces in an interesting way the progress of research on Light during the period indicated; and in *Researches in the Theory and Calculus of Operations*, by J. A. Paterson, we have a most elaborate and intricate investigation on the theory of the actions of various forces of Nature. Mr. C. H. Peck contributes a Synopsis of New York *Uncinulæ*.

LETTERS TO THE EDITOR

[The Editor does not hold himself responsible for opinions expressed by his correspondents. No notice is taken of anonymous communications.]

Microscopic Examination of Air

IN support of the conclusions arrived at by Mr. Douglas Cunningham, of Calcutta, in his "*Microscopic Examinations of Air*" (*NATURE*, vol. ix. p. 330), and in illustration of the method which he employed, perhaps I may be allowed to describe some observations of the same kind which I made three years ago but have not had leisure to continue or prepare for publication.

A sentence in Dr. Parkes' "*Manual of Hygiene*," alluding to the importance of minute examination of the air, turned my thoughts in that direction. The instrument which I constructed for the purpose was contrived after the manner of a weathercock, presenting the wide mouth of a funnel to the wind, while the

tube of the funnel was bent upwards and had an orifice about 1-20th of an inch in diameter. Close above this orifice was placed a glass slide, held by springs and bearing a drop of glycerine on its lower surface. The tube and glass slide were protected by a roof and two cheek-boards, which formed the vane of the weather-cock. The glass slide was so placed that the current of air issuing from the narrow orifice of the bent tube, under pressure of the wind on the wide mouth of the funnel, impinged on the centre of the drop of glycerine, and a large proportion of any solid matters carried by the air was caught on the glycerine. After a day or two, according to the weather, the slide was removed, a thin disk of glass was placed on the glycerine-drop, and the contents were then examined under the microscope, a duplicate slide being left in the aeroscope for the next observation.

This instrument depended for its function on the wind. If there was no wind, there was no current through the tube, and nothing was caught on the glycerine; but in general there was wind enough, and the captures were ample, often embarrassing by their multitude. The observations were mostly made in the neighbourhood of London, at the Greenwich Observatory. The nature of the captures varied according to the direction and velocity of the wind, the state of the weather, and the season of the year. A north-west wind, blowing over London, brought soot and globules of coal-tar, textile fibres, nondescript *débris*, a few vegetable spores, now and then an epithelial scale or two, always a number of half-cooked starch-grains (identified by their reaction with iodine and by traces of concentric lamination giving a black cross with the polariscope), and sometimes microscopic bread-crumbs (half-cooked starch-grains in meshes of gluten). The starch-grains were the most constant capture of all, in all seasons and for all directions of wind. They seem to be very durable. (If I remember rightly, M. Pouchet found starch-grains in all specimens of dust, even the most ancient, obtained from the neighbourhood of human dwellings.) A southerly wind, blowing from the country, brought a great variety of vegetable spores and pollen-grains and *débris*, with a smaller proportion of matters characteristic of town air. The size and quantity of the captures depended mainly on the velocity of the wind. Once or twice a strong wind swept a living acarus, or an entomostrocan, or the shell of a diatom into the glycerine. In dry windy weather a quantity of siliceous sand was caught, which gave trouble by tilting the disk when in preparation for the microscope, and the larger grains had to be removed with the point of a needle.

The most interesting variation in the character of the organic captures was that which depended on the season of the year. In January and February scarcely anything was found (besides *débris* and inorganic matter) but a few fragments of mycelium of some fungus; but with the first fine weather in March the glycerine began to yield good returns. Spherical grains of poplar pollen were caught in large numbers, thirty or forty in a single drop, though the nearest poplar tree was a quarter of a mile distant. These were soon followed by the triangular pollen of birch and hazel—trees depending, like poplar, on the agency of the wind for fertilisation. From this time onward, through spring and summer, a great number and variety of pollen grains were caught. Cryptogamic cells increased in number through the summer, and reached their maximum in the autumn, when brown septate spores and others of various kinds, which my imperfect knowledge did not enable me to identify, appeared in abundance. If left for some days, they began to germinate. Towards winter their number diminished, the latest being minute dark brown oval spores of some species of agaricus (?). The winter months were comparatively barren.

I did not find any Bacteria, but there were numbers of excessively minute particles, of which I could not tell the nature. Once, after leaving the aeroscope for several days, I found the glycerine swarming with a minute *torula* which had evidently multiplied in that pabulum. In fact the glycerine was fermenting.

Among these facts, the only one which seems to have any bearing on the question of the propagation of infectious diseases is the great prevalence of cryptogamic spores in the air in autumn, when those diseases are especially rife.

To avoid fallacy in the results obtained, I used to place two drops of glycerine on the same slide, but only directed the air-current against one of them; both were examined under the microscope, and the difference credited to the air. By using glycerine that had been boiled with carmine, many of the

organic captures were made more distinct: the nuclei of epithelial scales and of many other cells were brightly stained by the carmine. Glycerine had the disadvantage of absorbing moisture in damp weather and swelling to an inconvenient bulk. At such times I used oil instead, with good effect. My plan of examination was to sweep the whole disk in successive parallel zones, by the aid of mechanical stage-movement, and make record of every organic body that could be recognised. Such as I had not seen before were sketched with pen and ink and coloured chalk in a book devoted to that purpose.

It will be seen that my observations entirely support Mr. Cunningham's, as to the abundant presence of living spores in the air. I was satisfied that this branch of research, in the hands of one thoroughly familiar with these microscopic forms, would lead to results of great interest, and I heartily congratulate Mr. Cunningham on the valuable work which he has produced.

HUBERT AIRY

Animal Locomotion

MR. WALLACE's last letter seems to call for a word of explanation from me. I did not refer to the up stroke of the bird's wing because this was not the point in dispute. But in reply to Mr. Wallace's latest stricture—that I appear “to ignore the great downward reaction, added to gravitation, during every up stroke”—I would say (1) that the downward reaction is not great, (a) because, as Mr. Wallace has himself observed, of the valvular action of the feathers; (b) because of the convex form of the upper surface of the wing; and (c) in some cases, because the wing is less expanded in the up stroke. (2) As to the effect of gravitation, this was already allowed for in determining the resultant motion consequent on the down stroke, and must not be reckoned twice. Just as with an arrow shot from a bow, so with the bird; the motion consequent on the down stroke lasts long enough for the wings to be raised before it is spent. Mr. Wallace is certainly right in saying that the down stroke should counteract the downward reaction of the up stroke, but this downward reaction being slight cannot require “a highly-inclined upward motion,” and what is more, it cannot require that the under surface of the wing should be directed forwards as Dr. Pettigrew asserts.

Again, I do not say the movement of the wing as a whole is downward and backward, but that the action of its surface is in that direction. The Duke of Argyll is no doubt correct in maintaining that the wing as a whole moves in a perpendicular line, or perhaps with a slight forward overlap.

I cordially agree with Mr. Wallace that the matter is not to be settled by “discussing theoretically, but by observation and experiment;” still the elementary principles of mechanics may surely be heard in evidence without disadvantage even at the outset of the inquiry.

JAMES WARD

Trinity College, Cambridge, March 30

Rudimentary Organs

IN a former communication (NATURE, vol. ix. p. 361) I promised to advance what seems to me a probable cause—additional to those already known—of the reduction of useless structures. As before stated, it was suggested to me by the penetrating theory proposed by Mr. Darwin (NATURE, vol. viii. pp. 432 and 505), to which, indeed, it is but a supplement. Epitomising Mr. Darwin's conception as to the dwarfing influence of impoverished conditions, progressively reducing the average size of a useless structure, by means of free intercrossing; the present cause may be defined as the mere cessation of the selective influence from changed condition of life.

Suppose a structure to have been raised by natural selection from 0 to average size 100, and then to have become wholly useless. The selective influence would now not only be withdrawn, but reversed; for, through Economy of Growth—understanding by this term both the direct and the indirect influence of natural selection*—it would rigidly eliminate the variations 101, 102, 103, &c., and favour the variations 99, 98, 97, &c. For the sake of definition we shall neglect the influence of Economy acting below 100, and so isolate the effects due to the mere withdrawal of Selection. By the condition of our assumption, all variations above 100 are eliminated, while below 100 indiscrimi-

* See former communication, NATURE, vol. ix. p. 361.