

amusing fertility of imagination, the *disjecta membra* of birds, beasts, and fishes, being worked up together in a variety of fantastic forms which it would puzzle Mr. Darwin or Professor Owen to classify. The plates are accompanied by short descriptions, also by Mr. Cooke, and intended, he says, "as a key to aid the uninitiated in animal lore." We give our readers the following descriptions as a sample:—"Plate v. No. 1. An odd fish—Platax—with dress of a bivalve shell, *Pecten Gibbosus*. The feet of a sprat-loon, *Colymbus Stel-latus*, and tail of Beroe. No. 2. *Encrinurus entrocha*, a Lily-encrinite, wears the head-dress of a porpita, one of the Acalephæ. Her dress being of Flustra, her right arm is a Pentelasmis, her left a species of Serpula. No. 3. This pig-faced lady, whose body is '*Parasmilia centralis*,' has wings of *Avicula cygnipes* (both species from the chalk), and limbs of a bird (species unknown). Plate x. No. 1. This scaly creature, capped by Cephalaspis, has the feet of a Brazilian porcupine, the heterocercal tail of a Palæozoic fish, and the lower jaw and tusks of Dinotherium wherewith to scratch himself. Plate xiii. No. 3. This ancient spinster, truly Palæozoic, has the triturating teeth of a fish, *Cestracion Philipi*; her cap is an Argonauta, her body that of the Port Jackson shark, her fan (Spanish, of course) a Renilla. *Isis hippuris* furnishes her arms. Plate xviii. No. 1. This hollow character, formed of the lower jaw of the hippopotamus, has very diverse arms, the right being an Ancyloceras, the left *Hamites attenuatus*. His head-gear is well got up with hide, horns, and the beak of a spoonbill! Plate xx. No. 1, thanks to Monte Bolca and its elevated strata of dried fish, we have *Semiophorus vellifer* (a fish of the Eocene.) With Scutes on his neck, and the claws of a lion, he walks his chalks; an upper cretaceous shell, *Plagiostoma spinosum*, defends his body." Many of the plates remind us of the gambols of the crustaceæ and other marine animals in *Babil and Bijou*, and we have no doubt that Mr. Boucicault, in his next attempt to "improve the British Drama," will find in this volume an endless variety of suggestions for humorous stage effects. We must not omit to mention the admirable manner in which the drawings have been reproduced by Mr. Sawyer of the Autotype Fine Art Company, the plates being exact facsimiles of the drawings. We anticipate an extensive circulation for this beautifully-executed and entertaining work.

G. I. F. C.

*Abstract of the Reports of the Surveys and other Geographical Operations in India for 1870-71.*

WE learn from these reports that during the season of 1870-71, the Great Trigonometrical Survey has been proceeded with on six series, and the complete work is represented by 11,203 square miles of principal, and 10,076 of secondary triangulation. The total area surveyed up to 1871 by the Topographical Surveys which do not include the Topographical work of the Trigonometrical Survey, is 665,909 square miles, three times the area of France. The Geological Survey has been going on more briskly than in previous years, and the Geological Surveyors are gradually building up the materials which will enable a geological map of India to be prepared. The tidal observations, from which much was expected, and for which gauges were made and sent out to India more than two years ago, were not gone on with on account of the financial difficulties of the Indian government. The government has finally adopted Mr. Hunter's plan for the spelling of Indian names; it is as near an approach to what is known as the "scientific system," as the public in the present state of education are able to endure. The "scientific system" consists in scrupulously rendering letter for letter, without any particular care to preserve the pronunciation. Uniformity in the spelling of geographical names is a great matter, no matter on what principle it may be based.

## LETTERS TO THE EDITOR

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

## Inherited Instinct

THE following letter seems to me so valuable, and the accuracy of the statements vouched for by so high an authority, that I have obtained permission from Dr. Huggins to send it for publication. No one who has attended to animals either in a state of nature or domestication will doubt that many special fears, tastes, &c., which must have been acquired at a remote period, are now strictly inherited. This has been clearly proved to be the case by Mr. Spalding with chickens and turkeys just born, in his admirable article recently published in *Macmillan's Magazine*. It is probable that most inherited or instinctive feelings were originally acquired by slow degrees through habit and the experience of their utility; for instance the fear of man, which as I showed many years ago, is gained very slowly by birds on oceanic islands. It is, however, almost certain that many of the most wonderful instincts have been acquired independently of habit, through the preservation of useful variations of pre-existing instincts. Other instincts may have arisen suddenly in an individual and then been transmitted to its offspring, independently both of selection and serviceable experience, though subsequently strengthened by habit. The tumbler-pigeon is a case in point, for no one would have thought of teaching a pigeon to turn head over heels in the air; and until some bird exhibited a tendency in this direction, there could have been no selection. In the following case we see a specialised feeling of antipathy transmitted through three generations of dogs, as well as to some collateral members of the same family, and which must have been acquired within a very recent period. Unfortunately it is not known how the feeling first arose in the grandfather of Dr. Huggins's dog. We may suspect that it was due to some ill-treatment; but it may have originated without any assignable cause, as with certain animals in the Zoological Gardens, which, as I am assured by Mr. Bartlett, have taken a strong hatred to him and others without any provocation. As far as it can be ascertained, the great-grandfather of Dr. Huggins's dog did not evince the feeling of antipathy, described in the following letter.

CHARLES DARWIN

"I wish to communicate to you a curious case of an inherited mental peculiarity. I possess an English mastiff, by name Kepler, a son of the celebrated Turk out of Venus. I brought the dog, when six weeks old, from the stable in which he was born. The first time I took him out he started back in alarm at the first butcher's shop he had ever seen. I soon found he had a violent antipathy to butchers and butchers' shops. When six months old, a servant took him with her on an errand. At a short distance before coming to the house, she had to pass a butcher's shop; the dog threw himself down (being led with a string), and neither coaxing nor threats would make him pass the shop. The dog was too heavy to be carried; and as a crowd collected, the servant had to return with the dog more than a mile, and then go without him. This occurred about two years ago. The antipathy still continues, but the dog will pass nearer to a shop than he formerly would. About two months ago, in a little book on dogs published by Dean, I discovered that the same strange antipathy is shown by the father, Turk. I then wrote to Mr. Nichols, the former owner of Turk, to ask him for any information he might have on the point. He replied—'I can say that the same antipathy exists in King, the sire of Turk, in Turk, in Punch (son of Turk, out of Meg) and in Paris (son of Turk, out of Juno). Paris has the greatest antipathy, as he would hardly go into a street where a butcher's shop is, and would run away after passing

it. When a cart with a butcher's man came into the place where the dogs were kept, although they could not see him, they all were ready to break their chains. A master-butcher, dressed privately, called one evening on Paris's master to see the dog. He had hardly entered the house before the dog (though shut in) was so much excited that he had to be put into a shed, and the butcher was forced to leave without seeing the dog. The same dog at Hastings made a spring at a gentleman who came into the hotel. The owner caught the dog and apologised, and said he never knew him to do so before, except when a butcher came to his house. The gentleman at once said that was his business. So you see that they inherit these antipathies, and show a great deal of breed.'

"WILLIAM HUGGINS"

#### The unreasonable

MY attention has directed itself to a letter by Dr. Ingleby in your last number, containing two curious but inconsistent misrepresentations of my words, and therein something that, if the writer were not Dr. Ingleby, might be called an instructive instance of cynophatism or doggimangerness—the behaviour of one who will neither understand a thing himself, nor allow other folk to understand it. As, however, the writer is Dr. Ingleby, I feel sure that a less cursory contemplation of the matter will modify his views.

The following doctrines are in the *Kritik* :—

1. At the basis of the natural order is a transcendental object.

"Das transcendente Object, welches den äusseren Erscheinungen, ingleichen das, was der inneren Anschauung zum Grunde liegt, ist weder Materie, noch ein denkendes Wesen an sich selbst, sondern ein uns unbekannter Grund der Erscheinungen, die den empirischen Begriff von der ersten sowohl als zweiten art an die Hand geben." (IVth Paralogism, of Ideality; *First Edition*.)

2. The transcendental object is *unreasonable*, or evades the processes of human thought.

(a) Of the sensibility :—

"Die nichtsinnliche .. Ursache dieser Vorstellungen ist uns gänzlich unbekannt, und diese können wir daher nicht als Object anschauen." (VIth section of Antithetic.)

(b) Of the understanding :—

"Unser Verstand Dinge an sich selbst (nicht als Erscheinungen betrachtet) *Noumena* nennt. Aber er setzt sich auch selbst Grenzen, sie durch keine Kategorien zu erkennen, mithin sie nur unter dem Namen eines unbekanntes Etwas zu denken." (Ground of distinction between Phenomena and Noumena.)

3. The doctrine of the contradictions is one means by which we know this.

"Mann kann aber auch umgekehrt aus dieser Antinomie . . die transcendente Idealität der Erscheinungen . . indirect .. beweisen," &c. (VIIth section of Antithetic.)

The Kantian theory had two legs to stand upon; one the alleged necessity of mathematical axioms, the other these alleged necessary contradictions in our ideas of the natural order. How completely the first has been amputated I hope to have shortly an opportunity of showing in a course of lectures at the Royal Institution. The doctrine, that we may infer the existence of an unknowable from supposed contradictions in the knowable, "has been developed and extended by the great successors of Kant;" and when in "a later form" these contradictions were set forth from an ultimately empirical standpoint (not that of Hamilton, but of Spencer, as stated in my note) the doctrine became fit for notice in a scientific lecture. Only the contradictions themselves, however, could be criticised, and not the step from them to the existence of the unknowable, or the unknowability of the existent. And Kant's name could only be mentioned as the historical starting-point of the doctrine; whose importance for the empiricist is mainly due to the modifications it has undergone since his time.

If Dr. Ingleby will kindly look at my lecture (*Macmillan's Magazine*, October 1872) again, he will see that I have attributed to Kant no more than the above-quoted doctrines; that I never pretended to expound Kant's form of them, or their relation to the rest of his system; and that I never said nor accused anybody of saying either that the antithetic was unreasonable, or that any natural order of thought or things was unreasonable.

In regard to the other misrepresentations he speaks of, I shall be very glad indeed to be told of them, and to be set right, provided only they exist in my words, and not in the exuberant imagination of my critic.

London, Feb. 9

W. K. CLIFFORD

P.S.—There is an important error in p. 508 of the lecture in question. The surface-tension of camphor and water is *less* than that of water, not *greater*, as there stated. The general argument depends only on there being a difference.

#### Prof. Clifford on Curved Space

THE friend, who (as I stated in my letter in *NATURE*, Feb. 6) called my attention to Prof. Clifford's address in *Macmillan's Magazine* for October last, asked me certain questions respecting curved space, which I was quite unable to answer: and another friend, occupying the foremost place among English philosophers, has since communicated to me the great discomfort which Prof. Clifford's views had occasioned him, and suggested that I should comment upon them in *NATURE*. I am not sure that what I have to say will prove to be helpful either to my discomforted friend, or to truth: yet the doctrine of curved space is so extraordinary in itself, and so momentous in its consequences, if it be true, that it is a fair subject for sceptical scrutiny. Moreover, I do not conceive that in commenting upon it I am going *ultra crepidam*; for the nature of space is not a subject on which the mathematician can claim a monopoly. *In limine* allow me to express my regret that Prof. Clifford should have selected such a topic for the entertainment of a popular audience. It is quite incredible that any of his hearers could have apprehended his meaning. There was assuredly no need for the lecturer to have cast a glamour on their mental eye by the invocation of those awful names, Lobatchewsky and Gauss, Riemann and Helmholtz.

The principle, in exemplification of which Prof. Clifford expounded the doctrine in question, was this: that a law can be only provisionally universal (*i.e.* as "we find that it pays us to assume it"), but that it is theoretically universal, or true of all cases whatever, "is what we do not know of any law at all" p. 504. I fancy he would not include numerical formulæ under the term "law": else arithmetic and algebra would afford an infinity of examples of such a law. Be that as it may, he does not select an example from either of those sciences, but from Euclidian geometry. He takes the proposition established by Euclid, that in any plane triangle the three angles added together are equal to two right angles. This he asserts we do not know as a universal truth. I now quote his own words: "Now suppose that three points are taken in space, distant from one another as far as the sun is from  $\alpha$  Centauri, and that the shortest distances between these points are drawn so as to form a triangle: and suppose the angles of this triangle to be very accurately measured and added together; this can at present be done so accurately that the error shall certainly be less than one minute. Then I do not know that this sum [? apart from the question of error] would differ at all from two right angles; but also I do not know that the difference would be less than  $10''$ " If, then, after a sufficient number of observations it were found that the deviation were greater than the assigned limit of error (less than one minute), it would follow that the Euclidian law is not universal, and that for triangles of such dimensions it is not true. The conclusion would be, then, that our Tridimensional space is not a homaloid. We need not run our heads against the ghost of a fourth dimension; for the refinements of the geometer enable him to investigate a curved tridimensional space, just as he investigates a homaloidal tridimensional space. But all the same, it is absurd to attempt the interpretation of the results without supposing that fourth dimension as the *conditio sine qua non*.

Now we will suppose that the triangle in question has been surveyed, and that the sum of its three angles have been found to deviate from  $\pi$  far beyond the assigned limit of error: what have we really got thereby? The triangle, says Prof. Clifford, is formed by drawing "lines of shortest distance" between the three points in space. Is observation through a telescope drawing such a line? Be it so, for the sake of argument. Then, if the conclusion to be drawn is that space is curved, I ask does it or does it not follow that the sides of the triangle are themselves curved? Observe that if those seeming (to us) straight lines are really curves of an exceedingly small curvature, the Euclidian law is not touched. Of course, then, Prof. Clifford did not mean to assert that in a case in which the sides of a triangle are

THURSDAY, APRIL 3, 1873

## ORIGIN OF CERTAIN INSTINCTS

THE writer of the interesting article in NATURE of March 20 doubts whether my belief "that many of the most wonderful instincts have been acquired, independently of habit, through the preservation of useful variations of pre-existing instincts," means more than "that in a great many instances we cannot conceive how the instincts originated." This in one sense is perfectly true, but what I wished to bring prominently forward was simply that in certain cases instincts had not been acquired through the experience of their utility, with continued practice during successive generations. I had in my mind the case of neuter insects, which never leave offspring to inherit the teachings of experience, and which are themselves the offspring of parents which possess quite different instincts. The Hive-bee is the best known instance, as neither the queen nor the drones construct cells, secrete wax, collect honey, &c. If this had been the sole case, it might have been maintained that the queens, like the fertile females of humble-bees, had in former ages worked like the present neuters, and had thus gradually acquired these instincts; and that they had ever afterwards transmitted them to their sterile offspring, though they themselves no longer practised such instincts. But there are several species of Hive-bees (*Apis*) of which the sterile workers have somewhat different habits and instincts, as shown by their combs. There are also many species of ants, the fertile females of which are believed not themselves to work, but to be served by the neuters, which capture and drag them to their nests; and the instincts of the neuters in the different species of the same genus are often different. All who believe in the principle of evolution will admit that with social insects the closely allied species of the same genus are descended from a single parent-form; and yet the sterile workers of the several species have somehow acquired different instincts. This case appeared to me so remarkable that I discussed it at some length in my "Origin of Species;" but I do not expect that anyone who has less faith in natural selection than I have, will admit the explanation there given. Although he may explain in some other way, or leave unexplained, the development of the wondrous instincts possessed by the various sterile workers, he will, I think, be compelled to admit that they cannot have been acquired by the experience of one generation having been transmitted to a succeeding one. I should indeed be glad if anyone could show that there was some fallacy in this reasoning. It may be added that the possession of highly complex instincts, though not derived through conscious experience, does not at all preclude insects bringing into play their individual sagacity in modifying their work under new or peculiar circumstances; but such sagacity, as far as inheritance is concerned, as well as their instincts, can be modified or injured only by advantage being taken of variation in the minute brain of their parents, probably of their mothers.

The acquirement or development of certain reflex actions, in which muscles that cannot be influenced by the will are acted on, is a somewhat analogous case to that

of the above class of instincts, as I have shown in my recently published book on Expression; for consciousness, on which the sense of utility depends, cannot have come into play in the case of actions effected by involuntary muscles. The beautifully adapted movements of the iris, when the retina is stimulated by too much or too little light, is a case in point.

The writer of the article in referring to my words "the preservation of useful variations of pre-existing instincts" adds "the question is, whence these variations?" Nothing is more to be desired in natural history than that some one should be able to answer such a query. But as far as our present subject is concerned, the writer probably will admit that a multitude of variations have arisen, for instance in colour and in the character of the hair, feathers, horns, &c., which are quite independent of habit and of use in previous generations. It seems far from wonderful, considering the complex conditions to which the whole organisation is exposed during the successive stages of its development from the germ, that every part should be liable to occasional modifications: the wonder indeed is that any two individuals of the same species are at all closely alike. If this be admitted, why should not the brain, as well as all other parts of the body, sometimes vary in a slight degree, independently of useful experience and habit? Those physiologists, and there are many, who believe that a new mental characteristic cannot be transmitted to the child except through some modification of that material substratum which proceeds from the parents, and from which the brain of the child is ultimately developed, will not doubt that any cause which affects its development may, and often will, modify the transmitted mental characters. With species in a state of nature such modifications or variations would commonly lead to the partial or complete loss of an instinct, or to its perversion; and the individual would suffer. But if under the then existing conditions any such mental variation was serviceable, it would be preserved and fixed, and would ultimately become common to all the members of the species.

The writer of the article also takes up the case of the tumbling of the pigeon, which habit, if seen in a wild bird, would certainly have been called instinctive; more especially if, as has been asserted, it aids these birds in escaping from hawks. He suggests that it "is a fancy instinct, an outlet for the overflowing activity of a creature whose wants are all provided for without any exertion on its part;" but even on this supposition there must have been some physical cause which induced the first tumbler to spend its overflowing activity in a manner unlike that of any other bird in the world. The behaviour of the ground-tumbler or Lotan of India, renders it highly probable that in this sub-breed the tumbling is due to some affection of the brain, which has been transmitted from before the year 1600 to the present day. It is necessary gently to shake these birds, or in the case of the Kalmi Lotan, to touch them on the neck with a wand, in order to make them begin rolling over backwards on the ground. This they continue to do with extraordinary rapidity, until they are utterly exhausted, or even, as some say, until they die, unless they are taken up, held in the hands, and

soothed; and then they recover. It is well-known that certain lesions of the brain, or internal parasites, cause animals to turn incessantly round and round, either to the right or left, sometimes accompanied by a backward movement: and I have just read, through the kindness of Dr. Brunton, the account given by Mr. W. J. Moore (*Indian Medical Gazette*, Jan. and Feb. 1873) of the somewhat analogous result which followed from pricking the base of the brain of a pigeon with a needle. Birds thus treated roll over backwards in convulsions, in exactly the same manner as do the ground-tumblers; and the same effect is produced by giving them hydrocyanic acid with strychnine. One pigeon which had its brain thus pricked recovered perfectly, but continued ever afterwards to perform summersaults like a tumbler, though not belonging to any tumbling breed. The movement appears to be of the nature of a recurrent spasm or convulsion which throws the bird backwards, as in tetanus; it then recovers its balance, and is again thrown backwards. Whether this tendency originated from some accidental injury, or, as seems more probable, from some morbid affection of the brain, cannot be told; but at the present time the affection can hardly be called morbid in the case of common tumblers, as these birds are perfectly healthy and seem to enjoy performing their feats, or, as an old writer expresses it, "showing like footballs in the air." The habit apparently can be controlled to a certain extent by the will. But what more particularly concerns us is that it is strictly inherited. Young birds reared in an aviary which have never seen a pigeon tumble, take to it when first let free. The habit also varies much in degree in different individuals and in different sub-breeds; and it can be greatly augmented by continued selection, as seen in the house-tumblers, which can hardly rise more than a foot or two above the ground without going head over heels in the air. Fuller details on tumbler-pigeons, may be found in my "Variation of Animals under Domestication," vol. i. pp. 350, 309.

In conclusion, from the case of neuter insects, of certain reflex actions, and of movements such as those of the tumbler-pigeon, it seems to me in the highest degree probable that many instincts have originated from modifications or variations in the brain, which we in our ignorance most improperly call spontaneous or accidental; such variations having led, independently of experience and of habit, to changes in pre-existing instincts, or to quite new instincts, and these proving of service to the species, have been preserved and fixed, being, however, often strengthened or improved by subsequent habit.

With regard to the question of the means by which animals find their way home from a long distance, a striking account, in relation to man, will be found in the English translation of the Expedition to North Siberia, by Von Wrangell. He there describes the wonderful manner in which the natives kept a true course towards a particular spot, whilst passing for a long distance through hummocky ice, with incessant changes of direction, and with no guide in the heavens or on the frozen sea. He states (but I quote only from memory of many years standing) that he, an experienced surveyor, and using a compass, failed to do that which these savages easily effected. Yet no one will suppose that they possessed any special

sense which is quite absent in us. We must bear in mind that neither a compass, nor the north star, nor any other such sign, suffices to guide a man to a particular spot through an intricate country, or through hummocky ice, when many deviations from a straight course are inevitable, unless the deviations are allowed for, or a sort of "dead reckoning" is kept. All men are able to do this in a greater or less degree, and the natives of Siberia apparently to a wonderful extent, though probably in an unconscious manner. This is effected chiefly, no doubt, by eyesight, but partly, perhaps, by the sense of muscular movement, in the same manner as a man with his eyes blinded can proceed (and some men much better than others) for a short distance in a nearly straight line, or turn at right angles, or back again. The manner in which the sense of direction is sometimes suddenly disarranged in very old and feeble persons, and the feeling of strong distress which, as I know, has been experienced by persons when they have suddenly found out that they have been proceeding in a wholly unexpected and wrong direction, leads to the suspicion that some part of the brain is specialised for the function of direction. Whether animals may not possess the faculty of keeping a dead reckoning of their course in a much more perfect degree than can man; or whether this faculty may not come into play on the commencement of a journey when an animal is shut up in a basket, I will not attempt to discuss, as I have not sufficient data.

I am tempted to add one other case, but here again I am forced to quote from memory, as I have not my books at hand. Audubon kept a pinioned wild goose in confinement, and when the period of migration arrived, it became extremely restless, like all other migratory birds under similar circumstances; and at last it escaped. The poor creature then immediately began its long journey on foot, but its sense of direction seemed to have been perverted, for instead of travelling due southward, it proceeded in exactly the wrong direction, due northward.

CHARLES DARWIN

## UNIVERSITY OARS

### II.

WE resume our remarks at the point at which we left off last week, *i.e.* the uncomfortable one of the killed and wounded in the great annual battles on the Thames.

Of the 294 men who rowed in the 26 races taking place between the years 1829 and 1869 (both inclusive), 39 men have died, or rather we should say 40, for one other death has occurred, apparently since the introductory portion of the work was written, and the tables in the appendix were compiled, and we are assured on the authority of elaborate statistics and the logic of averages, that, in comparison with other portions of the civil community, this is a very moderate death-rate. Of the diseases which have carried off in youth or early manhood these 40 men, we will only instance one kind, as being the only one with which boat-racing can presumably be connected, namely consumption, "and other diseases of the chest:" to these perhaps may be added "heart affections." Of the former there are 9, of the latter 3, in all 12.

We are assured, again, that this percentage is a mode-