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 unintiated 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 Stellatus*, and tail of Beroe. No. 2. *Encrinus 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 663,909 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 cynophatnism 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 *transcendentale 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 sofort selbst Grenzen, sie durch keine Kategorien zu erkennen, mithin sie nur unter dem Namen eines unbekannten 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 transcendentale 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 *a* 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 quâ 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 π 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