

instances in various parts of the world in which *Papilios* of certain groups are the objects of mimicry. Although Mr. Scudder has never seen a bird capture a butterfly, others have been more fortunate, and that they are thus captured very largely in the tropics is certain. It is not improbable, from the rarity of mimicry in the temperate zone, that the few cases which exist may have been produced under the more favourable climatal and organic conditions of the semi-tropical epochs anterior to the glacial period.

ALFRED R. WALLACE

The Difficulties of Natural Selection

THE papers read by me before the Entomological Society "On the Relation between the Colour and the Edibility of Lepidoptera and their Larvæ" having been noticed and commented upon by Mr. A. W. Bennett and others in NATURE, I have deemed it desirable to offer a few remarks on the subject.

The object I had in making the experiments was to ascertain whether there could be proved to exist any relation between the colours of larvæ and their edibility.

The disciples of Mr. Darwin argued that the brilliant colours of so many male birds arose from sexual selection, and that the equally striking colours of flowers were but guides to insects, to enable them to distinguish, at some distance, the flowers from the leaves, and thus insure fertilisation by the interchange of pollen. Such reasons, however, were quite valueless to account for the bright colours of the asexual larvæ of many Lepidoptera, several species of which are banded and striped with blue, yellow, and red; colours which instead of concealing them by harmonising with the leaves on which they feed, are often in complete contrast with the n.

Now Mr. Wallace had a theory that these gaily coloured larvæ were uneatable by birds, and that their gay colours were protective, because if they were indistinguishable from eatable species, they would be seized by birds, and though rejected afterwards, would be so much injured that the probability of their becoming imagines would be very remote, even if they were not at once killed.

This I found to be the case; in my experiments extending over many years, and most carefully made with several species of birds, I have not met with one instance in which a strikingly-coloured larva was eaten. In most cases they were not even regarded when thrown into the aviary, although I had several birds always on the watch for the eatable species, with which I constantly fed them; while these latter were seized immediately they were seen.

The larva of the *Cucullia verbasci* is conspicuously coloured blue and yellow, and feeds without any attempt at concealment on several species of *Verbascum*. I placed the plants in the aviary, and fed the *Cucullia* upon them until every leaf was devoured, and the caterpillars gnawed holes in the stem; but not one was in the slightest degree injured, yet at the same time other larvæ were greedily eaten.

On the other hand, I found that all larvæ were eagerly eaten which have soft smooth bodies and dull colours, while the hairy larvæ are rejected entirely.

These eatable species are protected in various ways; some are nocturnal in their habits, descending to the ground during the day; some feeding on the under sides of the leaves; others arrange their bodies in a line with the shoots of the plants and look like a streak of the bark; some are of precisely the colour of the leaves, or even of the corolla of the plant on which they feed; others roll themselves up in leaves, the larvæ of the *Geometridæ* are often exactly like twigs, with the terminal and side buds imitated.

This latter resemblance is so complete that, after being thirty years an entomologist, I was deceived myself, and took out my pruning scissors to cut from a plum-tree a spur which I thought I had overlooked. This turned out to be a larva of a Geometer two inches long. I showed it to several members of my family, and defined a space of four inches in which it was to be seen; but none of them could see that it was a caterpillar. Surely this was a case of protective mimicry.

All the eatable larvæ agree in not moving when there appears the least danger, and very rarely moving at all during the day.

Even if there were no cases of protective mimicry in the larval states of Lepidoptera, I do not think that would be any argument against the existence of such in the perfect state. It appears to me rather that as so few specimens become imagines in proportion to the eggs produced, the more need is there that these few should survive.

I cannot, therefore, agree with Dr. Scudder in thinking that mimicry has been supposed to exist where it is least wanted, viz., in the perfect state of Lepidoptera. Nor can I coincide with Mr. Bennett that it is a matter of indifference to the supporters of the theory of Natural Selection whether twig-like caterpillars are eaten by birds or not. My point is that they are often so like twigs that they are passed over as such by insectivorous birds, and that the closer the resemblance the better their chance of escape.

I believe myself that Mr. Darwin's theory will survive, and even be benefited by, the criticisms of its opponents; but what I do dread is the injury it may receive from the false arguments of some of its illogical supporters.

Lest I may unwittingly place myself in the latter category, I will bring my remarks to a close.

J. JENNER WEIR

6, Haddo Villas, Blackheath, S. E.

Butterflies and Birds

A CORRESPONDENT in NATURE, Dec. 22, states that after fifteen years' experience in butterfly hunting, he has never seen one in a bird's bill. I was not aware the circumstance was unusual, for I have frequently seen the common sparrow chase and capture such butterflies as *V. urtica* and *P. rapæ*. It is quite a hare and greyhound affair, the butterfly often eluding for some time the swift pounces of its pursuer, so that the hunt is a long one.

T. G. B.

St. John's College, Cambridge

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Ceratodus Forsteri

SIR PHILIP GREY EGERTON presents his compliments to the Editor, and would esteem it a favour if he would insert the following paragraphs, from two letters recently received from Professor Agassiz, in an early number of NATURE. It will be gratifying to all men of science to know that the distinguished Professor has so far recovered from his late severe illness as to be able again to interest himself in scientific pursuits.

Oulton Park, Tarporley

Cambridge, November 9

"I am slowly recovering, and find myself gradually returning to the ways of active life. As I wake anew to feel an interest in scientific pursuits, there is nothing for which I have a greater longing than the fossil fishes. If I could leave my house I would fly to you to resume the examination of your and Lord Enniskillen's collections. The recent discovery of Kreffit has added fuel to the fire, and I feel the most intense desire to revise the facts bearing upon the relations of the Ganoids and Selachians in general, and more particularly those of the *Cœlocanthi*, to which, from the examination of the skeleton sent me by Kreffit, I find his *Ceratodus Forsteri* belongs. It will no doubt turn out that the Dipterini are close relations. In this connection I am reminded of what you once wrote to me of the teeth of *Ctenodus*. Will you now have the kindness to give me all the particulars? I am having sections of the teeth of *Ceratodus Forsteri* and some of the fossil species made for comparison. I have little doubt already that this genus will turn out to be one of the most curious *synthetic* types (I call them) in the animal kingdom, exhibiting characters of Placoids (Selachians) in the teeth, Ganoids in the scales, their embryonic characters in the preservation of a dorsal chord, instead of distinct bony vertebræ, and finally hollow bones as in birds."

Cambridge, Dec. 8

"I take it some of your naturalists will crow over what they will be pleased to call my stupendous mistake in referring the teeth of *Ceratodus* to the Selachians, when the fish proves to have large imbricated scales; and yet I never was more pleased than when I learned the fact, for it settles beyond dispute the existence in nature of types, to which I have long ago called attention, under the name of *synthetic types* (see my Essay on Classification), but of which naturalists have thus far taken little or no notice. When I described the teeth of *Ceratodus* as those of a distinct genus among the Cestracions, I was led to do so by appearances which secured for this association the assent of all naturalists. As long as the fossil teeth only were known, nobody questioned the relationship. Owen himself, in his 'Odontography,' mentions the teeth of *Ceratodus* and their structure, and has not a shadow of a doubt that I am right in placing that genus near Cestracion; and now comes the discovery that *Ctenodus*, a genus also referred to the Cestracions, is based upon the dental plate of a bony fish, closely allied to the one recently discovered by Kreffit, and referred by him to

the genus *Ceratodus*. Is not all this the most palpable evidence that there exist in nature types which combine structural features that are entirely separate in other types? and it is to such types I have applied the name of synthetic types."

Lumiere Cendree

It may perhaps be of some interest to you to know that the phenomena of "Lumiere cendree" was distinctly seen in Surrey on the evening of the 25th inst., between 4 and 5 P.M. With the aid of an opera-glass, I saw clearly the whole of the dark portion of the moon's disc; and some friends who were with me at the time were able to see it with the naked eye.

H. G. S. SMITH

Trinity College, Cambridge, Dec. 27

Measurement of Mass

WITH reference to the very favourable notice in your last number of my edition of Deschanel's "Traité de Physique," will you allow me to remark that my reason for rewriting the section on *mass* (§ 42) was that Deschanel, in accordance with what has been till recent years an almost universal custom, employs a variable unit of force, and, as depending upon this, a variable unit of mass, so that the number denoting the mass of one and the same body is diminished as the body is carried from the equator to the poles, and would increase up to infinity if the body fell to the centre of the earth.

The reviewer says, "the conception of *mass* is always a difficult one for a beginner." This is doubtless true when the conception is hampered with the inconsistencies arising from this vicious system of measurement; but I do not think the conception of a *pound* or *gramme* of matter presents much difficulty, and these are the units in which, according to the best modern usage, I have indicated that mass is to be expressed.

As regards the coefficient of absorption of ammonia, the reviewer is right. A mistake was committed in extracting the number from a table, of which, if I may judge by his initials, the reviewer is the author. In future, I would entreat him to make his tables more easy of reference.

J. D. EVERETT

Belfast, December 26

Hailstones

IN NATURE of the 15th there is an account of hailstones of a form deviating considerably from the spherical. Hailstones are frozen raindrops, and a rain-drop falling through a vacuum would of necessity be spherical, but in falling through the air it must tend to assume the form of least resistance, whatever that may be. I was told many years ago of hailstones which had been picked up and found to be of the form of Minié bullets. I do not vouch for the truth of this, but I think it likely; the Minié bullet was, I believe, the nearest approach to the form of least resistance that the inventor was able to arrive at.

JOSEPH JOHN MURPHY

Old Forge, Dunmurry, Co. Antrim, Dec. 20

Darlingtonia Californica

MR. ROBINSON'S suggestion, reported at page 159, as to the cultivation of this plant in England, has been anticipated by Messrs. Veitch and Sons, who have grown the plant for a considerable time in their houses at Chelsea.

In London, as in California, this curious plant possesses the same irresistible attraction to insects, and as I have repeatedly examined living plants at Chelsea, perhaps the following notes taken in connection with those printed in your last number may have some interest.

This so-called "pitcher plant," when fully grown, resembles in shape the upraised head and body of an excited cobra, with hood expanded and prepared for a spring; the head is at right angles with the hollow vertical body, and apparently presents no opening by which an insect could enter; under the place where the lower jaw would be, hang two large reddish appendages like the "wattles" of a fowl. At Chelsea this plant possesses such an extraordinary attraction for flies (principally blue-bottles), that the hollow "pitchers" are generally full of their dead bodies; what this attraction is I am unable to say, as the plant is scentless.

Last year I had a *Darlingtonia* before me for some three or four hours, whilst sketching it, and I then observed that the blow-flies made straight for it immediately they entered the room. Insects alight on the red "wattles" and then fly upwards into the (previously unseen) red-lipped entrance to the tube; owing to the sudden twist in the neck of the pitcher, they are at once compelled to descend the hollow body, and, as far as I have observed, they never return alive. They keep up a buzzing noise for half an hour or so, and then apparently die.

The old "pitchers" are generally full of dead flies, &c., and the lowermost insects, in rotting, cause the "pitchers" to decay and split, the flies within being then displayed. These dead flies often drop out through the fissures and become grouped round the bottom of the plant.

WORTHINGTON G. SMITH

Aurora Arcs in the East

I AM inclined to agree with Dr. Burder as to the invisibility of Auroras by daylight, yet I can confidently assure him that I have many times seen the arch "almost due east," that is when the extremities point N.N.W. and S.S.E. When such a phenomenon occurred in Newfoundland, some of the old weather-wise settlers would tell me to expect falling weather (snow or rain) on the following day, as the Northern Lights were in the south. But I am sorry to say that I did not note how often the Aurora appeared as above, but I *did* note that snow fell on *seventy-eight* consecutive days in the autumn of 1867 and commencement of the winter of 1868.

HENRY REEKS

The Milky Way

IN the number of NATURE for November 17, Mr. John Jeremiah states that "Heol y Gwynt" is the only proper Welsh name for the Milky Way. Such is far from being the case. I am acquainted with no less than *nine* other names, equally proper for that luminous appearance, such as *y llwybr llaethog*, *y ffordd laeth*, *llwybr y gwynt*, *galaeth*, *eirianrod*, *crygeidwen*, *caer Gwydion*, *llwybr Olwen*, and *llwybr y mab afradlawn*. Of these names, *y llwybr llaethog* and *y ffordd laeth* answer precisely to Milky Way; *llwybr y gwynt* (common enough in Carmarthen-shire) is synonymous with *heol y gwynt*; *galaeth* (from *llaeth*, milk) corresponds with galaxy; *eirianrod* signifies a bright circle; and *crygeidwen* a white cluster. To *caer Gwydion* (the mural enclosure of Gwydion) belongs a tale, which may be compared with the stories of classical antiquity on the same subject. Gwydion is a noted character in early Welsh romance, in which he figures as an astronomer and an enchanter. He was the son of Don, king of Llychlyn or Scandinavia, and is said to have lived in the fourth century. According to the Welsh poets, he travelled through the heavens in search of a lady, who had eloped with Gronwy Befr, and left a track behind him, which has ever since been called *Caer Gwydion*. When he found the faithless lady he changed her into an owl. His scientific acquirements are often mentioned in Welsh mythology, and frequent allusions are made to him as an enchanter by the early bards. He is said to have been instructed in magical arts by Math ab Mathonwy, and in the *Mabinogi*, or tale which bears the name of the latter, his achievements are detailed at length. According to some of the Welsh records he was buried at Morfa Dinlle, on the seashore near Carnarvon.

Gwydion is not the only one of the family of Don whose name is associated with astronomy. Don himself gave his name to the constellation of Cassiopeia, which is called in Welsh *Llys Don*, the Court of Don; and *Caer Arianrod*, the Corona Borealis or Northern Crown, is so called after his daughter Arianrod.

Llwybr Olwen (the path or course of Olwen) refers to another distinguished character in Welsh mythology. Olwen was the daughter of Ysbyddaden Bencawr, a prince of the Northern Britons, who lived in the sixth century. Her extreme beauty was proverbial, and her charms are frequently alluded to by the ancient bards. It is stated of her that four white trefoils sprang up wherever she trod, and from this circumstance she was called *Olwen*, or white track. She was sought in marriage by Cilhwch, prince of Clyddon, and his adventures in order to obtain her form the subject of the *Mabinogi* of Cilhwch and Olwen, which will be found printed, with an English translation, in Lady Charlotte Guest's "Mabinogion," ii. 197, 249.

What connection the other name, *llwybr y mab afradlawn* (the path or course of the prodigal son), may have with the