department where the complicated subjects bearing on the public health of India can be taught is warmly advocated.

It was with the idea of securing such means of study that Sir Henry Acland resigned his office into the hands of the Regius Professor of Medicine, Prof. Burdon-Sanderson, but, unfortunately, the University is not able to carry out the scheme, and it remains for some wealthy person to grasp the great importance of the various questions involved in the public health of India, and assist the University to provide the means required.

LETTERS TO THE EDITOR

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. No notice is taken of anonymous communications.]

Protective Mimicry.

I HAVE read, with special interest, both Sir George Hampson's remarks on certain cases of pseudo-mimicry and Mr. Ed. Poulton's answer to the same (NATURE, vol. lvii. pp. 364 and 389).

Now, as I am the person that was consulted on the subject by one of Sir G. Hampson's correspondents in India, I think myself entitled, and in a way even bound, as far as possible to remove some of the misgivings that seem to have crept into Mr. Poulton's appreciation as to the true bearing of the facts under discussion.

Though he agrees, on the one hand, with Sir G. Hampson as to the fact that "this and other like cases of mimicry are quite destructive of any interpretation of resemblance based on Bates' theory," he yet maintains, on the other, that "they do not similarly affect the Müllerian theory."

But this is precisely what I contend is contradicted by the facts in question. To make this clear, I shall only use Mr. Poulton's own statements and admissions.

"The Müllerian theory," he says, "supposes that a common type of appearance among distasteful insects in the same locality acts as a common advertisement to enemies, so that the loss of life which must ensue during the time in which each generation of enemies is being educated to avoid the owners of a particular type or pattern and colouring is shared between the species instead of being borne by each independently."

The theory, thus understood, seems to Mr. Poulton to be rather exemplified and confirmed than contradicted by the facts in question, and he therefore continues: "It is probable that *Teracoli* are on the whole avoided by birds; and if this is also true of the *Abraxas*, the resemblance may well be advantageous, in spite of the difference in station, even granting that the 'good round sum' of 6000 feet is an absolute barrier to the *Teracoli* below and the *Abraxas* above. But future investigation may show that they approach much nearer than this."

First of all this reasoning, which is openly all about admitted facts, looks rather as a running away from those facts to some wished-for possibilities. Besides Mr. Poulton grants, after all, that unless both types occur in the same locality and be exposed to the same enemies, no possible training of young birds can be conceived, and consequently no advantage can be supposed to accrue.

But what are the facts? For here, of course, I do not pretend to discuss what might take place in any possible supposition, nor even to find fault with the logical slip so very common among natural selection evolutionists, which consists in so confounding the simple admission that similarity of colour exists, or even is useful, as to conclude from it that it is therefore the result of usefulness.

Now, so long as we keep to facts, whether we consider the two species of butterflies themselves or their respective enemies, the conclusion is the same, and they both require distinct climatic conditions and distinct "habitats."

Willingly or not, we must resign ourselves to see the "good round sum" of 6000 feet, or rather the difference in climatic conditions and other "surroundings" represented by this difference in elevation in our regions of Southern India remain as an insuperable barrier between the above-named species of butterflies, and to much the same extent also between their enemies.

Far from coming into contact, therefore, they are thus kept by their habits apart from one another, and put under conditions quite different from those required for the possible application of even the Müllerian theory.

Finally, both from the evidence of these and many like facts and, as Mr. Plateau has so well demonstrated, from the trifling importance of colouring in the selection of insects by their enemies, it is, to say the least, difficult to see how the facts of similarity in colour, shape, &c.—which for shortness sake we may even call "mimicry"—can be interpreted or explained by any possible theory based on simple natural selection. And I would, in conclusion, remark that I distrust all such theories not, as Mr. Poulton seems to believe, "on the ground that the evidence is not demonstrative," but because, far from offering an intelligible and possible explanation of facts, they simply stand in contradiction with them and mislead us as to their real meaning.

J. CASTETS, S.J.

St. Joseph's College, Trichinopoly, India, June 8.

I DO not propose to deal with Mr. Castets' objections to natural selection in general. They have often been met before. As to the special case under discussion, he feels that his knowledge of the distribution of the two species is exhaustive enough to give him safe warrant for the assertion that they are invariably separated by a height of 6000 feet. If this conclusion is well founded, it is an important contribution to the facts of the case under discussion. Nevertheless neither this nor the climatic differences need affect the Müllerian theory if the barrier which separates the one form from the other is crossed by the enemies of both. The *Teracoli*-like appearance of the moth is remarkable, and separates it very sharply from its allies. It occurs on an elevated district surrounded by lower country in which the *Teracoli* abounds. The approximation is sufficient to render the Müllerian theory a probable explanation in view of the immense number of similar relationships accompanying a closer approximation in other parts of the world, and considering the complete absence of any other explanation; unless, indeed, Mr. Castets intends to imply, by so constantly dwelling upon one aspect of the environment, that the difference in climate is responsible for the agreement in appearance.

Oxford, June 30.

E. B. POULTON.

Epidemics among Mice.

REFERRING to a paragraph in your issue of June 23 (p. 179), relative to the discovery by Dr. Issatschenko of a new microbe pathogenic to rats, I would call attention to some articles by Prof. F. Loeffler on epidemics among mice, &c., in the *Centralblatt für Bacteriologie und Parasitenkunde*, Band xi. pp. 129-141 (February 10, 1892), and Band xii. pp. 1-17 (July 5, 1892), which will be found translated in a Blue Book entitled, "Report of the Departmental Committee appointed by the Board of Agriculture to inquire into a Plague of Field-Voles in Scotland, with Minutes of Evidence and Appendices and a copy of the Minute appointing the Committee" (1893). Translations of the above papers form Appendix vi. of this Report; and Prof. Loeffler's second paper relates his successful efforts to employ the "*Bacillus typhi murium*" to destroy field-voles in Thessaly.

It would be interesting to know whether the microbe discovered by Dr. Issatschenko is the same as that described by Prof. Loeffler, or a different species.

W. F. KIRBY.

Chiswick, June 25.

Remarkable Hailstones.

ON Sunday, June 26, a district to the south of Manchester was visited by a thunderstorm, which was remarkable for its accompaniment of heavy hail. The storm came from the same quarter as the cool surface wind, viz. north-east, and reached its height about 2.15 p.m.

Preceded by a lull in the heavy rain, hail, accompanied by lightning, began to fall, and continued to do so for five minutes.

The most noticeable fact was the peculiar shape of the hailstones. These were conical in shape, about $\frac{1}{2}$ inch long, and $\frac{3}{8}$ broad in widest part. In longitudinal section they showed (a) opaque white bands; (b) clear, colourless bands; (c) semi-opaque bands, dotted with more opaque portions.

All of those examined agreed in possessing transparent portions at the vertex and base. On making a transverse section through one of the opaque bands, it was seen to consist of (a) narrow clear channels intersecting the surface; (b) opaque

masses, many of an uniform size, separated by the above-mentioned clear, transparent channels.

The general appearance of this transverse section inclined one to regard the stone as built up of a number of conical spicules, with their vertices pointing towards the vertex of the stone.

This was confirmed by the fact that one of the stones, whilst melting, was squeezed between the thumb and finger, and immediately fell apart into three distinct spicules.

SAMUEL N. PLAYER.

126 Burton Road, West Didsbury, Manchester.

Dendritic Patterns caused by Evaporation.

I WAS glad to see the note (with illustrations) published in NATURE (June 23) on this subject. Among the specimens which I did not mention in my paper are two microscope slides similar to those described by Prof. G. H. Bryan. They are botanical slides from the collection in my laboratory at Bedford College, and as they were bought specimens, I was not certain that they had been mounted in glycerine jelly, although I believed it was probably the medium used. I therefore laid them aside for future work, and am now pleased to find the probability confirmed. I wished also to make further experiments on the relation of the structure to the included specimen.

I should like to point out, however, that although the medium does not contain recognisable particles in suspension, we may look upon the jelly as representing material in an extremely fine state of division, as it were, so that the principle of formation may be similar to that in the other slides described.

July 1.

CATHERINE A. RAISIN.

Solar Halo of July 3.

IN case it may interest your readers, I write to say that there has been a magnificent halo round the sun, lasting almost without interruption from 4 p.m. to 6 p.m.

It varied in intensity during the time of its visibility, and also in colour. When at its best it was distinctly bluish at its outer margin, shading through yellow to red; the more decidedly green and pink tints of the rainbow seemed to be wanting. But the most conspicuous feature of the apparition was the comparative darkness of the sky within the ring. The halo appeared as if fringing a dark storm-cloud; but that this was not really the case, was evident from the sun's appearance.

All day, in fact for several days past, the sky has been exceptionally much decorated with fantastic cirrus clouds, and this afternoon, at the time of the halo, veils of cirrus concealed almost all the blue; while a lower layer of cumulus clouds drifted up from the west and gradually obscured the sun, halo and all, for a time.

I do not know if the halo formed a complete ring round the sun, as trees partly concealed my view; but I was able to trace it for fully three-quarters of its circumference.

Bradfield, Reading, July 3.

CATHARINE O. STEVENS.

A Monochromatic Rainbow.

A CURIOUS rainbow was observed here on Friday evening last. Heavy rain falling in a dark southern sky formed the lower portion of one limb of a bow, extending about 10° directly towards the zenith. The red band alone was visible, and lasted *after sunset* (which occurred at 8.40 for our horizon, and some ten minutes earlier below the Howgill Fells), for a full quarter of an hour.

A. J. K. MARTYN.

Sedburgh, July 3.

CAST METAL WORK FROM BENIN.

AMONG the spoils, interesting to ethnologists, brought back from Benin by the punitive expedition under Admiral Rawson, was a large number of elaborately carved elephant's tusks, some of them of remarkable length; various smaller objects in ivory; profusely ornamented wooden panels forming doors and looking-glass frames, and hundreds of objects of great multiplicity of design cast in metal, both in the round and in high relief. The wonderful technical skill displayed in the construction of the metal objects, their lavish ornamentation, much

of which is deeply undercut, and in nearly every case the high artistic excellence of the completed subject, have been a surprise and a puzzle to all students of West African ethnology. If they have now begun to recover from their surprise that work of such excellence, indicating skill born of long experience, should have come to light from among so barbarous a race, and that no whisper of its existence should have reached Europe, notwithstanding its great abundance (as attested by the numerous pieces exposed in London and provincial auction rooms, in addition to the hundreds of plaques and figures sent to the British Museum); there has, at all events, been as yet no elucidation of the mysteries—who were its manufacturers, where and when was it executed, and whence did they derive the knowledge of this art?

Although the city has been described as being, in the middle of the seventeenth century, "of greater civility than to be expected among such Barbarous People," none of the travellers who, within the past two or three hundred years, have left accounts of their visits to Benin, have described this metal work as a special feature of interest there. If the amount that has already found its way to Europe had been displayed in the king's or chiefs' houses, or in their public buildings, it could not surely have failed to attract attention and remark. The artificers and their appliances for the manufacture of works, on so large a scale, could hardly also, one would suppose, escape notice, or be passed over in silence, if observed. More than one traveller mentions seeing blacksmiths at work and turning out good workmanship, "considering the appliances they have"; but no foundry work or modellers in clay or wax are referred to.

Tusk-holders in the form of human-headed vases have certainly been alluded to; and the nearest approach to a description of the plaques is the "melted copper whereon are Ingraven their Warlike Deeds and Battels, kept with exceeding curiosity," mentioned in Ogilby's collection of African travels. Few, however, if any, of the plaques brought to Europe display warlike deeds or battle scenes. The accompanying illustrations are taken from examples lately acquired by the City of Liverpool, and described by Dr. Forbes in vol. i. No. 2 of the *Bulletin of the Liverpool Museums*—a recently established periodical, intended to make known the contents of the Derby (or Zoological) and the Mayer (or Ethnological) Museums, and the results of the investigations carried on in the laboratories attached to them.

Fig. 1 represents a small plaque, used as a lid of a box, or perhaps as a pendant, in which the king or some high personage is shown, supported by two slaves; while in Fig. 2, is illustrated one of the human-headed vases which sat on the altar in the king's principal Juju-house, supporting a carved elephant tusk. The head-dress of this figure is a network of coral strings with pendants, set off on both sides by rosettes of larger beads of a different sort. Encircling the neck as high as the lower lips are thirty-one coral ropes, forming the collar, which is the insignia of a high dignitary.

On the face may be observed his tribal marks, consisting of three raised weals over the outer corners of each eye, and of two long perpendicular lines running down the front of the forehead above each inner corner. These last probably represented ordinary tattoo marks on the brow, as they are represented by bands of iron, ingeniously let into the metal during the casting. In the same way the pupils of the eye are formed by round discs of iron. The whole figure has been very carefully chiselled over; and when it was newly finished, there is little doubt that the steel-blue tattoo lines and the glistening pupils gave to the face and eyes a very life-like appearance.

The projecting circular flange of the base has depicted