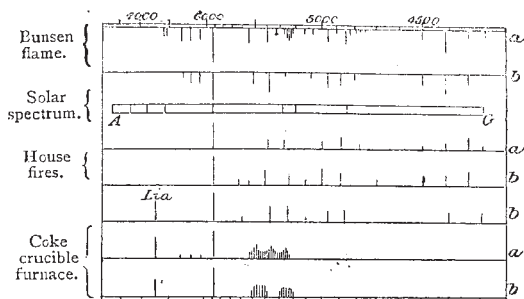


lines, green, blue, and indigo, was noticed also in jets of flame projecting from above the lid of a coke crucible furnace in which copper and brass were being melted (the first of the three furnace spectra in the figure), where the presence of a chloride would not be so readily suspected. The same furnace was revisited, and fired for experiment in different ways, but it only showed the copper-flame spectra drawn in the last two lines of the figure, whose total colour is olive, or tawny green, quite different in aspect from the rich blue of the flame first seen and identified with that occurring in ordinary fires. As refuse brass and copper articles are consigned for melting to these crucibles, it is, however, not improbable that copper chloride may in this instance have been introduced among them.

Attempting to discover the cause of the blue fire-flame by examinations of artificial spectra led me to try that of the blue flame found by Prof. Barrett (NATURE, vol. v. p. 483) to be produced when a burning jet of hydrogen is allowed to play upon



Spectra of the blue flame of copper-chloride, naturally and artificially produced; observed, *a*, with Browning's miniature spectroscope with reflected micrometer scale; *b*, with punctured-scale pocket-spectroscope.

the surface of sulphuric acid, or upon the surface of any object, indeed, which has contracted dust by exposure to the air. It is very abundant, and readily produced everywhere, and not less intensely blue than the copper flame; but no distinct measurements or notable appearances of its spectral bands could be obtained. I could, however, corroborate Prof. Barrett's observations of the extension of the blue colour only on the surfaces touched, and its want of penetration into the body of the flame; and I noticed that metal surfaces rubbed with sulphur which remain cool exhibit it more brightly than wood or other sulphurised surfaces which are quickly heated in the flame. A paste of coke-dust and sulphur wetted with water ceases to tinge the flame (as does also sulphuric acid) when it grows warm, and it fails to colour it when dry. The brightest blue flame was obtained by directing the burning jet upon a mixture of snow with coke dust and sulphur, pounded together in a mortar, the reason apparently being that great attenuation of the sulphur-vapour, and therefore a low temperature of the sulphur, is required to enable the sulphur compound formed to exhibit its characteristic blue-coloured spectrum in the flame.

A. S. HERSCHEL

Zoological Geography—*Didus* and *Didunculus*

My use of the expression "a near congener" seems, from Prof. Newton's letter in your number of July 4, to have diverted attention from the point to which I desired to direct it.

If the bird of the Navigator group had presented such near congeners to the Dodo as does the other of the ground birds (*Pezophaps*) known from the Mascarene Archipelago, this would have been startling, but as it is the degree of relationship (I avoid the word "congener" which gave rise to Mr. Newton's correction) seems to me to bear out the argument as to former geographical connections which I so long ago advanced.

Both birds belong to the *Columba* and to that all but extinct branch of the family to which the term "ground dove" has been applied; and the wingless condition of the Dodo has been by one great living authority accounted for on the hypothesis that by being confined to islands and so secured against enemies, and finding food on the ground, this queer pigeon gradually lost the necessity for, and with this the use of its wings, and thus acquired its bulky form and ground habits. Instead of this, however, I believe that both the *Didide* and *Didunculus* are survivors from mesozoic times, of a great family in which the characters that connect these ground birds with the winged

Columba were those common to a large order of wingless birds that, like other orders of mesozoic life, have since perished. From this ancient order of life, or from some yet more ancient stem combining their common characters, the winged *Columba* may have been evolved; but of the order itself *Didunculus* has, I believe, survived at the eastern side (longitude 170° W.) of the ancient continent to which I in my first letter alluded, and the Dodo and its kindred at the western (long. 58° E.), in both cases by the protection afforded by insulation.

The application which I sought to make of this to the case of the tortoises was that the presence of those reptiles in the Mascarene and Galapagos archipelagos is due to the same geographical change. The osteological differences between the tortoises of the two regions may, perhaps, be less than those between *Didus* and *Didunculus*; but if so, this, in a lower and cold-blooded grade of vertebrate life, would not weigh much; and my contention is that the tortoises of the Galapagos are insulated there by survival from the eastern extremity of this ancient continent, and those of Aldabra, in the Mascarene region, by survival from the western, instead of from land extending across Africa and the Atlantic to South America, as supposed by Dr. Günther. The fossils of the Himalayan and Mediterranean regions prove that the great tortoises lived on the Europeo-Asiatic continent in miocene and older pliocene times (becoming extinct during the latter), but this does not appear to me to negative the conclusion drawn above.

To prevent misconception, I should, perhaps, add that the land tract from the submergence of which the Mascarene archipelago and the differentiation of the immediate kindred of the Dodo originated (as suggested by Prof. Newton in the memoir in the *Phil. Trans.* of 1869, to which he refers), was in my view but a fragment of the more ancient and far more extensive continent which (in 1860) I attempted to show occupied the southern hemisphere in mesozoic times; and that such fragment, again, was but a remnant of a still larger portion of this great southern continent, which, as far back as the triassic period, had become separated from the Australian portion, and, so late as the earlier part of the tertiary, occupied much of the Indian Ocean, where, during the eocene or miocene periods, it formed the cradle of the human race.

SEARLES V. WOOD, JUN.

July 13

P.S.—Dr. Forbes speaks of *Didunculus* being somewhat plentiful still in Upolu.

Smell and Hearing in Insects

IN NATURE (vol. xvii. pp. 45, 62, 82, 102, 162-3), which has just reached me, I see a discussion as to the senses of smelling and hearing in moths, to which I add my mite as an old observer.

I do not see how any one can doubt the first. What but the sense of smell directs nocturnal insects to their food? At this moment I have in my verandah a parrot, which is daily regaled with a portion of a banana. Every evening I see a dozen, or more, of the large *Sphinxidae* and *Noctue* trying to effect an entrance into the cage to get at the rotting fruit, which is generally invisible from the outside, being behind the flap of wood that serves for a door; the cage is only a rough box. I have always found bananas the best bait to attract the night-flyers, but only when they began to rot.

Again, how about "smelling"? Here the odour must be very subtle. A virgin female is instantly detected, while not one "gay Lothario" will visit a captive matron.

It is harder to say whether insects hear sounds, or feel them, as the same effect would be produced on them by either faculty. I have seen both moths and butterflies turn towards sound, and direct their antennae to it, moving them to and fro. I have noticed larvæ—as remarked by one of your correspondents—assume certain attitudes on being affected by sound; these attitudes are, I think you will find, generally those assumed for protection or concealment; the creatures are, in fact, alarmed at the unusual—noise? or vibration?—which?

I will adduce one remarkable case in support of the smelling power. Years ago I had (while residing in the North of Ceylon) a lot of living *Achatina panthera* sent to me by the late Mr. Blyth. I placed them in a breeding-cage, and, to secure them from rats, suspended it to the ceiling of my drawing-room. We soon noticed that every night the floor of the room was covered with glow-worms, at which, never having seen them in that part of the island before, and they being of unusual size and brilliancy, we were much pleased.