them increases the horizontal pressure, as is proved by the fact that windmills evolve more work than they would be calculated to evolve if the pressure were the same as when they are at rest. The great difficulty, however, in all these explanations is that birds soar under circumstances which render these explanations inapplicable. In the open ocean, where a steady wind is blowing, where there are certainly no upward convection-currents, and where, equally certainly, there are no cross currents or diverse horizontal currents, where from the smoke of the steamer it is obvious that the air is moving *quasi* rigidly—that is, without perceptible internal motion—birds nevertheless soar to perfection.

As definite instances, however, are of more value than abstract statements, I subjoin copy of an actual observation made by myself and a friend some years ago. As the eyes become tired and dazzled in following the same object intently, we took it in turns to watch the bird, exchanging watch when the bird was so situated as to be easily identified.

"*Walmer Castle*, May 4, 1876" (on voyage home from the Cape).—"Observed a common gull for 11 minutes by the watch, following the ship without flapping a wing. The wings were used occasionally, but with a slow motion, as if for balancing or changing direction. The tail was occasionally altered in position when the bird ascended or descended.

"During the time of observation, the bird sometimes followed the ship with a steady motion, without apparently changing its height or velocity. Occasionally it veered to right or left a distance of a hundred yards or so, it rose and fell in altitude, changed its direction, fell back or overtook the vessel, without any apparent muscular effort. In overtaking the ship it seemed rather to rise than to fall" (though this is very difficult to judge of, because one cannot allow with any exactness for perspective or parallactic change of position).

"The direction of the wind, relatively to the ship, was E. by N., its velocity, as estimated by Captain Webster, was 7. The course of the ship was N.E. $\frac{1}{2}$ N., its rate 8 knots.

"While following the ship, the bird was often within 15 yards, at which time there was no perceptible inequality in the horizontal angles of its wings, and no perceptible angle made by the axis of its body with the ship's keel.

"In moving to right or left out of the ship's course, there was generally a change of level."

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The Value of Attractive Characters to Fungi.

THE importance of attractive colours and odours and of modifications of form to flowering plants is now perfectly understood; but the value of attractive characters to fungi has received comparatively little recognition. At first sight it would seem unnecessary that a plant, insusceptible of fertilization, should possess characters apparently designed to enlist living creatures in its service: there is no pollen for them to carry, and no ripe seeds for them to distribute, and yet attractive characters, such as colour, taste, and odour, are extremely well marked.

The colours which fungi exhibit include almost every hue from white to black. We have the brilliant red of the *Peziza* cups; the orange-scarlet of the *Amanita muscarius*, with its cap gaily speckled with white; the crimson of the *Russula emetica*; the rich yellow of the *Cantharellus cibarius*; the blue of the bruised *Boletus luridus*; the amethyst of the *Agaricus laccatus*; and the dark green of the bruised *Lactarius deliciosus*, with every possible shade to the deepest jet. But not only have fungi colours that are attractive by day; some, like the *Agaricus olearius*, are phosphorescent by night. Many tropical species light up the jungle in the hours of darkness; and in this country the coal-mines are often found illuminated by one of the poly-pores which propagates itself on the timbers of the workings.

The tastes and odours of fungi are equally varied and attractive. Many Agarics have an odour of fresh meal; the *Hydnum repandum* rejoices in the flavour of oysters; the *Armillaria mucidus* in that of nuts; the yellow Chanterelle in that of apricots; others have the scents of various flowers, such as the violet and woodruff; or of aromatics like anise; while a large number have an indescribable damp cellar or fungus smell, such as slugs delight in. Many, like the shameless stinkhorn, *Phallus impudicus*, emit an intolerable stench which so strongly resembles

"the carrion of some woodland thing"

that blow-flies and ravens quickly find it out.

There can be little doubt that these are attractive characters.

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What, then, can be the service which these characters induce animals to perform for fungi? To answer this let us review briefly the life-history of any fungus possessing characters of an attractive kind.

The common mushroom, *Psalliota campestris*, is particularly agreeable to sheep and oxen, and is abundant in autumn in rich pastures. Although there is still much in our knowledge of its life-history that is incomplete, yet it is evidently composed of two main periods: first, a parasitic period passed in the body of an animal host; and secondly, a saprophytic period passed on some suitable organic soil. Let us sow the spores of a ripe mushroom as carefully as we may, none of them will grow: the first stage of the mushroom's existence must be passed in the body of an animal host; and as horses, sheep, and oxen are all readily attracted by its taste and mealy smell, it has never any difficulty in finding a host to take it in.

When once the spores have passed from the body of the host, they produce a mycelium, from which the future mushroom is formed. The connection between fungi and animal droppings is a matter of very early observation, and our forefathers were wont to believe that certain evil species came from the body of the Wicked One, and familiarly called them Tode's-stools, or Devil's droppings.

In this division of the life-history of fungi I believe we have the key to the value of attractive characters. Horses, oxen, sheep, foxes, squirrels, moles, birds, snails, and insects are all attracted by appropriate scents, tastes, and colours; and the forms and habitats of fungi are those which have best succeeded in attracting their particular hosts. There is no living being either great enough or small enough to escape the attentions of these plants in their ceaseless endeavours to attract; and among fungi, just as among flowering plants, every variation of form, scent, and colour has been perpetuated and developed, because it has been successful in attracting and in thus securing the multiplication of the species.

The subject is one, I think, that requires the gathering together of much individual observation in all parts of the world; and it would be well if those who have the opportunity would note at the time the name of the fungus and its observed host, and if students of biology who possess facilities for laboratory work would follow the matter still further by artificial cultures, and so determine the changes that take place in the body of the host, and the course of the alternating sexual and agamous generations.

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Extraordinary Flight of Leaves.

MR. SHAW's letter (*NATURE*, vol. xlii. p. 637) is a curiously corroborative fact in support of Mr. Wallace's theory of the wind being an agent for the dispersion of seeds, which he so strongly urges in his book, "Darwinism," to account for the universal distribution of many plants. For if, as the letter intimates, such weighty objects as oak-leaves can be conveyed through the air in such vast numbers as to cover an area two miles long by one in width, then it would not require a wide stretch of imagination to conceive that miniature objects like seeds, delicately winged for flight by Nature as so many are, might travel by thousands for hundreds of miles in favourable winds.

Speaking of leaves, on the morning of that severe frost last week, I observed a horse-chestnut, in full foliage, showering down its leaves with extraordinary rapidity, so that in three hours the tree was bare—half the leaves were yellow, the rest still quite green. The gardener gathered twelve large barrow-loads from beneath it.

R. HAIG THOMAS.

November 1.

Kœnig's Superior Beats.

THE interesting experiments of Dr. Kœnig at the meeting of the Physical Society on May 16, and described in *NATURE* (vol. xlii. p. 190), have induced me to offer your readers the following view of Dr. Kœnig's superior beats and beat-tones.

If we look for the physical cause of the superior beats, we find nothing but the inferior beats themselves to build upon. But if we can admit that inferior beats may be in an ascending and descending scale of intensities, we have at once the structure of a beat which may be appropriately termed a superior beat, viz. the beat resulting from the periodic recurrence of a maximum