Now I suppose there is not a sportsman in the country who has not witnessed these phenomena scores and scores of times, and I dare say there is scarcely one of that numerous body who, if asked to assign the cause of these phenomena, would hesitate for a moment in his reply. From the time he first saw a bird tower, he has probably satisfied himself that the current hypothesis is the only one that can explain the curious facts; and if his interrogator should venture to doubt that cerebral injury is this cause, he would probably point to a drop of blood in the beak as a final answer to such scepticism. This drop of blood has doubtless always seemed to him such a complete verification of the current hypothesis, that he has probably never waited to ask himself the following questions:—1. Why is towering so common? The head of a partridge or grouse is a small object, and therefore not likely to be often hit. Moreover, common sense may show that if towering is due to cerebral injury, such injury must be of a very local and definite character as regards the brain: some particular part of that organ must be injured to the exclusion of all other parts, or else the effect would be instant death. This consideration would lead us to expect that towering, if it is due to cerebral injury, should be of exceedingly rare occurrence. 2. Why does a bird always fly some considerable distance before towering? If the action is due to cerebral injury, we should expect the former to ensue immediately upon the infliction of the latter. 3. Why is the distance which a bird flies before towering so variable? 4. Why is the height to which it does tower so variable? 5. Why is it that birds tower most frequently when shot from behind? 6. Why is it that we never see the hole in the skull through which the pellet has passed?

In view of these difficulties besetting the ordinary hypothesis, and in the hope of ascertaining the exact seat of cerebral injury if this hypothesis were the true one, I have last year and this year dissected a number of partridges which I had observed to tower, and in every case I found the cause of death to be the same, viz., pulmonary hæmorrhage. In all my specimens the lungs were gorged with extravasated blood. It thus becomes impossible to doubt that we have here the true cause of towering; and, as is always the case with true causes, examination will show that it is sufficient to explain all the effects. Towering is common, because the lungs expose a large area to receive the shot, and an area which is especially liable to be crossed by a single pellet from a bad marksman when, as is most usual, the bird is shot from behind. The bird always flies a considerable distance after being hit, because it takes time for the blood to pour into the spongy texture of the lungs from the open ends of the severed blood-vessels. The distance flown is variable, because it depends on the size and number of the severed blood-vessels—*i.e.*, the rapidity of the bleeding—which of course is also variable. The height to which the bird towers is variable, because depending on the same cause. The drop of blood in the beak comes from the bleeding lungs through the wind-pipe—the latter organ in most of my dissections having been found full of clotted blood. Lastly, we do not find any indications, either externally or internally, of cerebral injury, for the simple reason that no such injury has taken place.

Any one who is not a physiologist may here ask, Why does pulmonary hæmorrhage give rise to such very peculiar movements as those that occur in towering? The answer must certainly be, that in these towering movements—which, be it remembered, only take place immediately before death—we have to do with the characteristically convulsive movements which in all animals mark the last stages of asphyxia. That in birds these movements should show themselves mainly in the wings, might, I think, be reasonably expected, seeing that the pectorals are the principal muscles in the body—and all sportsmen are aware how the particular birds in question exhibit violent fluttering motions of their wings when dying from any violent cause, just as rabbits, under similar circumstances, exhibit violent galloping motions of their principal muscle-masses in the hind legs. But why the convulsive movements of asphyxia should show themselves in these birds in the form of upward flight, is a question which I cannot answer. It seems, however, to be a question of some interest to the physiologist, and if worked out might possibly tend to elucidate that obscure subject, the mechanism of flight. Of course to investigate the phenomena of towering, asphyxia of birds would require to be produced in the laboratory; and here I must leave the matter in other hands, for although I have a licence to suffocate as many birds as I can in the pursuit of sport, I have no licence to suffocate a single bird in the pursuit of science.

And, in conclusion, may I suggest that those sportsmen who annually conduct their experiments on asphyxia by the thousand, should endeavour to glean from them one result of some little value to science? It would be of interest to know what birds tower and what birds do not. So far as my own observation extends, the peculiarity in question seems to be confined to members of the grouse genus, nearly all the endemic species of which I have observed to tower. But, excepting those species, I have never known any other bird to do so. By publishing this notice in your columns, therefore, I hope to obtain information from any of your readers who may have observed the well-known phenomena in birds of other genera.

GEORGE J. ROMANES

### Squirrels

ON the lawn before the window near which I am writing is erected a tripod of three lofty poles, at the summit of which is suspended a basket containing nuts and walnuts. The squirrels, of which there are many in the shrubberies and adjoining plantations, ascend these poles, extract a nut from the basket, and quickly make their way down and across the lawn, in various parts of which they bury their nuts, scratching a hole in the green turf, putting in a nut, filling up the hole, and, lastly, with much energy, patting the loose materials with their feet till the filling-up is made firm and solid. This morning for a considerable time only one squirrel was at work, giving me a better opportunity of observing the mode of operation. His journeys were made in all directions, and varied from 5 feet to nearly 100 yards, never, so far as I could observe, going twice to the same place or even nearly so. The squirrels, I am told, forget the spots where they hide the nuts, and in the following spring the lawn, which is very spacious, is dotted with the young plants of nuts and walnuts. As the colours of flowers attracting bees and moths promote fertilisation, so the racy flavour of a nut, irresistible to a squirrel, contributes to the distribution of its kind.

Turvey Abbey, November HENRY H. HIGGINS

### Mr. Harris's Challenge to Mathematicians

IN an advertisement in NATURE (vol. xv., p. xxxviii.) Mr. Harris (Kuklos) challenges mathematicians "to examine and disprove if they can" his published demonstration of the value of $\pi$. Presumably he reads this publication; if so, we would direct his attention to an article on "Cyclometers and some other Paradoxers" in vol. xii., p. 560, vol. xiii., p. 28. The part which is concerned with his approximation will be found on p. 29. Reasoning, however, which we venture to think will satisfy mathematicians, may not, we fear, convince Mr. Harris.

THE WRITER OF THE ARTICLE

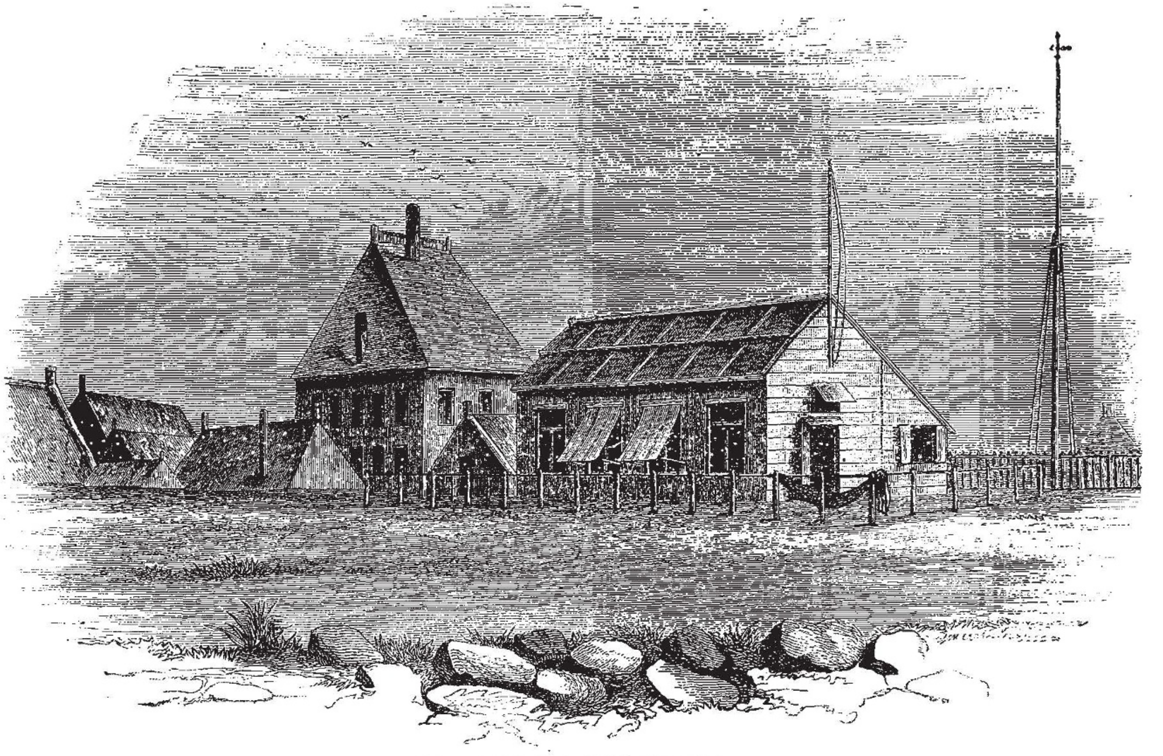
December 4

## A ZOOLOGICAL STATION ON THE NORTH SEA

REFERENCE was made in NATURE (vol. xiv. p. 535) to the resolutions passed at the recent meeting of the Association of German Naturalists and Physicians at Hamburg, as to the establishment of zoologico-botanical stations on the German coast. The distinguished names of those appointed to draw up a memorandum, which is to be presented to the Imperial Chancellor, the Bundesrath, and the Governments of the several States of the Empire, will no doubt be of the greatest service in securing success to a scheme so universally approved of by all students of biology.

The following is a brief sketch of similar endeavours made in Holland a year ago and of the results arrrived at during the summer of 1876:—The Netherlands Zoological Association, at a meeting held in November, 1875, recognised the necessity of founding an establishment on the Dutch coast, where anatomical and microscopical investigations of the fauna and flora of the North Sea might be carried on at leisure, and which could at the same time be made serviceable for physical, chemical, and meteorological observations on this part of the German Ocean. A committee, consisting of Prof. Hoffmann, Drs. Hoek and Hubrecht was appointed to take the necessary steps towards the realisation of this scheme, and to provide temporary accommodation during the summer months of 1876, where members of the Association might engage in these pursuits. In February, 1876, the Committee was obliged to report that no suitable accommodation was to be found in those localities on the Dutch coast, where the erection of a zoological station might prove a success, and that the funds of the Association would not suffice to carry out the scheme on the scale to which an institution like this ought to aim at from the beginning. The committee proposed to raise the necessary funds by a public subscription as well as by the issue of shares of 10 guilders each, paying no interest, but terminating within a fixed number of years. The Association might thus obtain a building of its own, which, if it were made of wood, might be transportable from one locality on the coast to another according to season and varying abundance of the material for study. This proposal was agreed to, and within a few weeks about 400*l*. were raised, a sum more than sufficient to commence with.

Accordingly a wooden shed similar to those which had served the Dutch astronomical party for the observation of the transit of Venus in Réunion was constructed. It has four windows on each side with corresponding working tables and a small room adjoining, where the vessels containing marine animals may be kept in darkness, and where an apparatus for oxygenising the sea-water is to be kept in constant working order. This embryo zoological station, more resembling a block-house in the back woods than Dohrn's well-known institution, is, however, fitted out with all the requisites for histological and microscopical research prescribed by the different methods of investigation of the present day. Next to the numerous chemical desiderata a store of glass and crockeryware is kept in readiness, a stock of standard works and other



Transportable Zoological Station, 1876.

books which may in any way prove useful is selected from the library of the Association; in short, everything provided for, microscopes and steel instruments only excepted. A set of dredges, towing nets, cross-bars with hempen swabs for scraping the bottom (Marion, Lacaze Duthiers), pelagic nets, &c., complete the inventory, and have to serve for the daily renewal of those marine forms which would be the objects of investigation in the station itself.

In the first week of July all this was transported to Helder, the northern seaport opposite to the Island of Texel, and erected on the top of the great dyke which there protects the Low Countries behind from inroads of the sea. Regular dredging parties were organised, the work being carried on partly in sailing vessels hired for the occasion, partly by means of a small steamer belonging to the Navy, which the Minister of the Marine placed at the disposal of the Zoological Association. The work was carried on for eight weeks; towards the end of August, when continual bad weather set in, the station was closed, taken down, and transported back to Leyden, in order to be erected again on another point of the coast next summer.

During those two months ten members of the Association availed themselves of the opportunity of studying the marine fauna of that part of the Dutch coast, and in many branches interesting results have been arrived at which will in time be published in the Annual Reports of the Association. The shifting sands, which everywhere form the bottom round the coasts of Holland as well as the total absence of rocks and cliffs may explain the deficiency of many sessile forms which form so conspicuous a part of the fauna of the French and British coasts. Crustaceans and Annelids were numerically, perhaps, the best represented; next came the Medusæ, the Hydroid-polyps, the Polyzoa, and different representatives of the classes of Molluscs and Echinoderms. Gephyreans were not met with, neither were Holothurians. As to Ascidians, they were represented by the composite Botryllidæ, which could be had in immense numbers in some of the shallower parts at the entrance of the Zuyder Zee, mostly attached to blades of the Zostera. The stones employed in the construction of the great dyke, which are partly lying loose, were of importance, as they usually covered over the haunts of numerous Crustaceans, Nemerteans, &c. A no less rich harvest was got from the driftwood now and then met with, and from the wooden palings serving in the construction of the wharfs, &c., in the harbour, which were submerged at high tide.

Altogether this first summer of the Dutch Zoological Station gave ample proof of its practicability. It would perhaps be a good idea to act conjointly in future with the German men of science, and to add a third permanent station to those proposed in the German Committee's Report (Kiel and Heligoland), say at Flushing. If, then, one other station were to be erected on the English or Scotch coast (St. Andrew's Bay ?), a conjoint attack could be made on the mysteries still hidden in that part of the ocean which is inclosed by our neighbouring coasts. The healthy competition which would arise out of this division of the work to be done, can only be favourable to the common end—an accurate knowledge of the natural history of our own seas, and a constant opportunity of studying their animal and vegetable productions in the fresh state.

## *SENSITIVE FLAME APPARATUS FOR ORDINARY GAS PRESSURE, AND SOME OBSERVATIONS THEREON*

A GLASS or metallic tube, about 5 inches long, and $\frac{5}{8}$ in diameter, is closed at one end with a perforated cork, through this cork slides a piece of $\frac{1}{8}$ inch tubing, about 6 inches long. One end of this is either drawn out to a jet, or closed in the blow-pipe flame to reduce its diameter to about $\frac{1}{16}$ inch, and the other end is connected to a gas supply. (Fig. 1.)

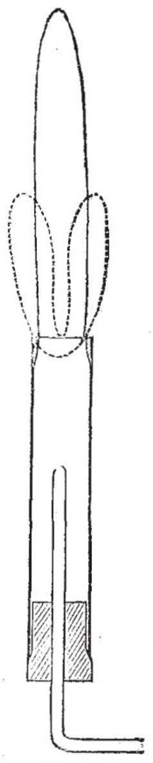


Fig. 1.

The outer tube is held in a suitable support, and the inner tube is pushed through the cork till it nearly reaches the mouth of the outer one, and a light then applied. It now gives a long steady flame.

*Experiment I.*—Lower the inner tube till the flame is on the point of roaring. It will now be found very sensitive to noise. Snapping the fingers at a distance of eight or ten yards will cause it to contract fully $\frac{4}{5}$ of its height. The most suitable flame for this is about 6 inches high.

*Experiment II.*—Adjust the gas to give a flame of about $4\frac{1}{2}$ inches high, and gradually raise the inner tube. A point will be reached at which the flame becomes sensitive, not to noise, but note; and it will be found to respond to a certain note by dividing into two portions, and while this note is produced it will continue divided. It is difficult to keep the exact note by whistling with the mouth, and therefore a glass whistle with paper slider should be used, or, better still, a singing tube with adjustment.

*Experiment III.*—Arrange two singing tubes to give the responding note. The flame divides. Now make one tube a little sharper than the other, so as to beat slowly. The alæ of the flame alternately recede and coalesce.

*Experiment IV.*—Using the whistle; blow it so hard as to produce higher octaves of the responding note. The flame will be unaffected, as though in perfect silence.

The dimensions of the instrument are open to great variation, and also the size of the flame. For lecture work, a flame $1\frac{1}{2}$ or 2 feet would be more suitable, though less sensitive, and neither dividing nor shortening so perfectly as the sizes given above. It will act effectively with any pressure of gas, from $\frac{1}{10}$ inch (of water) upwards, and the sliding jet makes it equally sensitive with a large or small gas supply.

*Observations on the Escape of Gas from Contracted Openings, and on a Differential Pressure Indicator.*

Glass tubes of about $\frac{1}{4}$ in. bore are joined as shown in Fig. 2. At D the tube is slightly bent so as to retain a little drop of water. The gas enters at C, and then divides into two channels, one towards B, the other towards A.

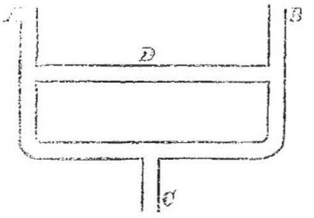



Fig. 2.

If one of the exits be contracted, say B, then the water moves towards A. Certain precautions have to be observed, the conditional arrangements of which need not be mentioned here.

*Experiment I.*—Connect to each, A and B, a tapering jet, and C with the gas supply. Get the water stationary. Now light, say, B, the water will move towards A, showing that the exit of the gas is retarded by being ignited.

This is rather a remarkable result, seeing that the gas is hotter, and therefore more mobile, and also that the heat must enlarge the aperture. Now light A, and the water will return to zero.

*Experiment II.*—Connect B with a sensitive flame apparatus, A remaining as before, light and adjust to zero. Now sound the responding note and the water moves towards A, showing that the outflow of gas is retarded by a certain note. Now adjust the sensitive flame for noise, and rapidly snap the fingers or stamp the foot, and the water will still move towards A.

*Experiment III.*—Arrange as in II., then extinguish the sensitive flame and readjust to zero. Produce the responding note, and the same movement of the water will be observed. This shows that an issuing jet is affected in the same manner by a sound, whether ignited or otherwise.

*Experiment IV.*—Fix the sensitive flame apparatus adjusted for note under a large jar open at both ends. A large stoppered gas jar answers very well. Fix three balls of spongy platinum, *a*, *b*, and *c*, upon a piece of thin platinum wire so that the point of the quiescent flame just reaches *b*, and the points of the responding flame reach *a* and *c* respectively. Now extinguish the flame without turning off the gas. The issuing gas will cause the ignition of *b*. Now sound the responding note, and *b* will cool, and *a* and *c* will be ignited. This confirms the previous observations, and forms a rather pretty lecture experiment. The object of the gas jar is merely to protect from air currents.

R. H. RIDOUT