here on the horns of a dilemma. He evidently puts the cart before the horse. It is the movements of the heart which determine the movements of the blood, and not the converse.

The cardiac movements are due to a change of shape in the sarcous elements or ultimate particles of the muscular fibres of the heart, and in the adult organ can only be effected by a vital and alternate elongation and shortening of all the fibres composing the heart; the elongation occurring during the diastole and the shortening during the systole. Similar remarks are to be made of the voluntary muscles which, as stated in my work on "Animal Locomotion," are endowed with centrifugal and centripetal movements.

That the opening and closing of the ventricles of the heart are in no way connected with the passage of blood through the substance of the organ, is proved indirectly by the movements of the heart of the embryo. Here the heart opens and closes with time-regulated beat, while yet a mass of cells, and before it contains blood either in its cavities *or in its substance*. But that the presence of blood is not necessary to such movements is placed beyond doubt, for rhythmic movements occur in the vacuoles of certain plants, as *e.g.* the *Volvox globator*, *Gonium pectorale*, and *Chlamydomonas*, where no blood is present.

Lastly, if a frog be slightly curarised and its spinal cord destroyed, it is found, on exposing the heart, that the sinus venosus, vena cava inferior, the auricles and ventricles *are quite destitute of blood*, and yet the organ beats normally and with the utmost regularity. Mr. Garrod has consequently not yet succeeded in answering my query as to how the diastole of the left ventricle is produced. He has failed to show that it is not effected by the *active elongation or centrifugal movements of all its fibres*.

J. BELL PETTIGREW

Lakes with two Outfalls

HAVING observed the discussion lately carried on in your pages as to the existence of lakes with two outfalls, I think the following description of such a lake by Prof. Bell, of the Geological Survey of Canada, may be interesting to some of your readers. It occurs on the summit of the high Laurentian country between Lake Superior and Hudson's Bay:—

"In crossing the country from Lake Nipigon to the Albany River, we first followed the Ombabika River to its source, which is in Shoal Lake, three and a half miles long and one mile wide, lying at a distance of twenty-five miles north-east of the mouth of the river. This lake lies due north and south, and discharges both ways, the stream flowing northward towards the Albany, called the Powitik River, being nearly as large as the southern outlet. No portage occurs on the Ombabika for about nine miles before reaching Shoal Lake, nor for nearly five miles beyond its northern outlet; so that we passed the height of land with the greatest possible ease, having had about seventeen miles of uninterrupted canoe navigation, from the time we made the last portage, in going up the southern side, till we came to the first on going down on the northern. Shoal Lake has an elevation of scarcely 300 ft. over Lake Nipigon, or about 1,200 ft. above the sea."—"Report of Progress Geological Survey of Canada for 1871-72," p. 107.

GEORGE M. DAWSON

Montreal, Feb. 19

The Ink of the Cuttle-fish

WITH reference to the interesting account in NATURE, vol. ix. p. 332, of a gigantic Cephalopod captured in American waters, and of a still larger one, which attacked the boat belonging to some fishermen near Newfoundland, by twining its arms round the vessel, and which, having had two of those arms cut off by the fishermen, moved off, "ejecting a large quantity of inky fluid to cover its retreat," I desire to draw attention to an observation respecting this fluid, which I made on the occasion of a visit to the Crystal Palace Aquarium. My friend Mr. Lloyd was good enough to dislodge a cuttle from its place of concealment, and the usual inky discharge followed, as the creature shot across the tank. Mr. Lloyd states in his interesting "Handbook to the Marine Aquarium," "that the ink (which is viscid) does not generally become diffused through the water as writing ink would be, but is suspended in the water in a kind of compact cloud till it gradually settles down, and is dispersed in flakes." Now I quite think, with Mr. Lloyd, that this being the case, it is difficult to perceive how, according to the generally received opinion, its retreat is covered by the ejected cloud. It seems to me more likely that this discharge is to divert the attention of a pursuer—a dog-fish for instance—which would for the moment be startled by the sudden appearance of masses of dark colour in the water, and in the confusion the cuttle makes his escape.

Now that public aquaria are becoming so general in our great towns, it is much to be hoped that this and many other interesting problems in marine zoology may be solved.

Birmingham, Feb. 28 W. R. HUGHES

Transmission of Light in a Squall

ON the Admiralty Pier, Dover, during a "squally" gale, I remarked an occasional jerking or unsteadiness in one of the adjacent lights, say two miles off, to one of the coast-guard's men with whom I was talking at the time.

To him this was a well-known observation in squally weather. At times, he said, two lights could distinctly be seen for a second or so; frequently the shape of the light was changed, by elongation, vertically and horizontally.

The above phenomenon, if not generally known, might be worth noticing and verifyin in your excellent paper.

I suppose an explanation is to be found in the different densities of the atmosphere through which a ray of light must pass in rough unsteady weather; the second image being simply the persistence of the one seen immediately before the change in position of the ray by refraction.

JAMES C. INGLIS

DR. LIVINGSTONE AND THE CAMERON EXPEDITION

IN NATURE for Feb. 26, we expressed the desire which we felt, in common with our readers, for information respecting the orders that have been sent to Zanzibar as to the disposal of Dr. Livingstone's body. We now have great pleasure in being able to announce that Lord Derby acted with the promptitude and energy which might be expected from a statesman who has always shown a warm sympathy for the cause of geography. With the concurrence of the family, his Lordship has sent a telegram ordering the body of the illustrious traveller to be sent to England, and we believe that it is to be accompanied by one or two of Livingstone's faithful negro followers.

The melancholy death of Dr. Dillon and the return of Lieut. Murphy, leaves Lieut. Cameron alone, to proceed to Ujiji, to recover the box of papers left there by Livingstone, and to prosecute further geographical exploration. Heavy unforeseen expenses obliged Lieut. Cameron, who has proved himself to be a resolute and observant explorer, to purchase stores at exorbitant rates at Unyanyembe. The necessity for providing for the march of Murphy and Dillon to the coast, with Livingstone's body and most of his followers, is his complete justification for incurring this unauthorised expenditure, and there can be no doubt that the Geographical Society will treat its gallant emissary in a generous and liberal spirit. Cameron has suffered cruelly from fever and ophthalmia, and he is now resolutely pressing onwards in the performance of his work—the Society's work—in the face of greater difficulties than were encountered by any previous expedition. He carries with him our warmest wishes for his success, and the sympathy of every true geographer in England.

ON THE NEW RHINOCEROS AT THE ZOOLOGICAL GARDENS

A GLANCE at our list of additions to the Zoological Gardens during the last week will inform the reader that the Zoological Society has been successful in adding to its already unrivalled collection of specimens of the genus Rhinoceros still another species, which is exhibited for the first time in the Society's collection, and most probably in this country.

It is well known amongst naturalists that in Asia there are to be found two species of Rhinoceros, with a single horn developed on the top of the nose. The

larger of these is the gigantic Indian Rhinoceros (*R. unicornis*), many specimens of which have been brought to this country, and a very fine male example of which is living in the Regent's Park Gardens. In it the skin, which is immensely thick, is thrown into massive folds or shields, making the animal appear as if clad in armour-plating. Each shield is thickly studded with nearly circular slightly-raised tubercles, which look very much like the heads of innumerable bolts intended to strengthen and retain the shield in position. The folds that surround the neck, where it joins the head, are very ample, producing the appearance of the now so fashionable ruff, somewhat modified. According to the observations of the late Mr. Edward Blyth, the Indian Rhinoceros is found only at the foot of the Himalayan hills, and in the province of Assam, along the valley of the Brahmapootra.

The second species of one-horned Rhinoceros is generally called the Javan Rhinoceros (*R. sondaicus*). It is found in Java, and in the country stretching from Malacca up through Burmah to Assam. It is considerably smaller than the Indian species; the shields are not so strongly marked, and are not arranged in an exactly similar manner, the gluteal shield not being completely divided into two by a transverse fold situated half-way down it; and the middle neck fold, instead of running backwards on each side before it reaches the spine, crosses the middle line, and so divides off a saddle-shaped shield, which is median, and as deep from before backwards as from side to side. The fold which surrounds the neck is also much less significant, and the head is narrower and less formidable in aspect. The tuberculation of the shields is more slightly marked, and each tubercle is proportionately smaller in diameter.

It is a specimen of this Javan Rhinoceros (*R. sondaicus*), a nearly full-grown male from Java itself, which the Zoological Society has succeeded in purchasing, and which is now exhibited in the same house as the Indian species, so that every opportunity is at last afforded for a more minute study of the differences which will most probably be found to distinguish the two species.

The other species of Asiatic Rhinoceroses, namely, the Sumatran Rhinoceros (*R. sumatranus*), and the Hairy-eared Rhinoceros (*R. lasiotis*), are both two-horned, and have been divided off as a separate genus, that of *Ceratorhinus*, by Dr. J. E. Gray. The skin is not divided into shields, and is thinner than in the one-horned species. The type specimen of the Hairy-eared Rhinoceros, the only example known, is now living in the Zoological Gardens. About a year ago the Sumatran animal was also represented, and rumour says that the gap caused by its loss will not be long unfilled.

NEIL ARNOTT, M.D., F.R.S.

WE have this week to record the death of this well-known man of science, which took place at his residence in Cumberland Terrace, Regent's Park, on the 2nd inst. He was born at Arbroath in May 1788, and had consequently reached his eighty-sixth year.

While Neil was yet young his father died, and the family removed to Aberdeen. Neil went to the Aberdeen Grammar School, being there with Lord Byron, and succeeded so well in the one thing then taught, Latin, that he gained a bursary by a competition in Marischal College, which he entered in 1801. In his third year he came under Patrick Copeland, Professor of Natural Philosophy, renowned for his admirable course of lectures, and especially for his power of experimental illustration. Arnott was one of Copeland's best pupils, and afterwards turned to full account the careful notes that he had made of the lectures.

He began the study of medicine in Aberdeen, and in 1806 he went to London to prosecute the study. Young Arnott, while his medical education was still incomplete, went aboard an Indiaman, as assistant-surgeon, making the usual voyage of a trading East Indiaman in those days. He was the intellect and soul of the ship, associating with everyone that could learn or teach anything; he was the resource in all serious emergencies, of whatever kind.

On his return to England, in 1811, he settled as a medical practitioner in London. He was the chief medical adviser to a colony of French refugees who settled in Camden Town, and also became physician to the French and Spanish Embassies, his fluency in languages serving him in good stead. It was about 1823 that he first turned to account his studies in natural philosophy, by giving in his own house a course of lectures both on the general subject and on its applications to medicine. These lectures formed the basis of the "Physics," the first volume of which appeared in 1827, and gained for the author an instantaneous and wide-spread reputation. The first edition was sold in a week after being reviewed by the *Times*. In a few years five editions were exhausted, and the work was translated into all the languages of Europe. The freshness and popular character of his style recommended the book to the general public, and did not prevent its favourable reception by the highest scientific authorities; Herschel and Whewell both gave emphatic testimonies to its accuracy and originality. The author was thenceforth recognised as a man of science and an inventor of no mean order. His practice as a physician was extended, and he became a Fellow of the Royal Society. On the foundation of the University of London in 1836 he was nominated a member of the Senate, and in 1837 he was named Physician Extraordinary to the Queen.

In 1838 he published a treatise on warming and ventilating, and in this he described the stove since called by his name. He introduced the water-beds, and made many other useful applications of physics to medical and surgical practice. For many years he had withdrawn from medical practice. He had a large circle of friends in and out of the profession. His conversational powers, his large range of scientific knowledge, and his geniality of manner, will be long remembered by those who now regret his loss.

*OZONE**

II.

SOME of the properties of ozone have already been referred to. At the common temperature of the atmosphere, it may be preserved, if dry, for a very long time in sealed tubes, but by slow degrees it becomes changed again into ordinary oxygen. This conversion goes on more rapidly as the temperature is raised, and at 237° C. it is almost instantaneous ("Phil. Trans." for 1856, p. 12). The alteration of volume which occurs at the same time has been already sufficiently described. A similar effect to that of heat is produced by several oxides, such as the oxide of silver or the peroxide of manganese, which by contact, or, as it is termed, catalytically, instantly change ozone into ordinary oxygen. Ozone is also destroyed by agitation with water, provided the ozone is in a highly diluted state. But the most interesting fact of this kind is one which I have recently observed, and which I hope to be able to exhibit to the Society. Dry ozone, even if present in such quantities as freely to redden iodide of potassium paper, is readily destroyed by agitating it strongly with glass in fine fragments, although, as we have seen, it may be preserved for an almost indefinite period in sealed glass tubes. This experiment, as it appears to me, forms a new and closer link than any hitherto observed between a purely mechanical action and a chemical change.

Ozone is a powerful oxidising agent. It attacks metallic mercury and silver with great energy, and converts them into oxides. The experiment with mercury is very striking, and is a delicate test for ozone, either in the dry or moist state. A few bubbles

* An Address delivered before the Royal Society of Edinburgh on December 22, 1873, by Dr. Andrews, LL.D., F.R.S., Honorary Fellow of the Royal Society of Edinburgh. (Continued from p. 349.)