is not really much more difficult than the dressing of a child for church. The most remarkable part of the process is the painting of the forehead, trunk, and ears, which follows a thorough washing. "The designs are often good, and the whole serai, excepting always the elephant himself, is deeply interested. His mind and trunk wander; he trifles with the colour-pots; so with each stroke comes an order to stand still. Some mahouts are quite skilful in this pattern work."

In an interesting chapter on the training of animals, Mr. Kipling shows that the skill of the natives of India in this difficult art has often been greatly overrated. The Oriental brings "boundless patience" to the task, but "he has no steadfastness of aim, nor has he sufficient firmness of hand and will to secure confidence and obedience." The cheetah or hunting leopard (*Felis jubata*), when caught and tamed, undergoes so little training in the field that it loses its natural dash, and is often left behind by the antelope. It becomes so mild

FIG. 4.—A restless bedfellow.

that it is frequently allowed to curl itself under the same blanket with its keeper. The keeper, when his bedfellow is restless, "lazily stretches out an arm from his end of the cot, and dangles a tassel over the animal's head, which seems to soothe him." In the early morning Mr. Kipling has seen a cheetah "sitting up on his couch, a red blanket half covering him, his tasselled red hood pushed awry, looking exactly like an elderly gentleman in a nightcap, as he yawned with the irresolute air of one who is in doubt whether he will rise or turn in for yet another nap." This is mentioned as an instance of the curious intimacy that exists in India between animals and those who have charge of them.

Of the remaining chapters we can only say that all of them embody the results of a close study of the animal world and of the Hindu character. We may note as of especial interest the three concluding chapters, on animals in Indian art, on beast fights, and on animals and the supernatural.

ON AN OPTICAL PROOF OF THE EXISTENCE OF SUSPENDED MATTER IN FLAMES.[1]

DEAR PROFESSOR TAIT,—I write to put on paper an account of the observation I mentioned to you to-night, in case you should think it worth communicating to the Royal Society of Edinburgh.

In the course of last summer I was led, in connection with some questions about lighthouses, to pass a beam of sunlight, condensed by a lens, through the flame of a candle. I noticed that where the cone of rays cut the luminous envelope there were two patches of light brighter than the general flame, which were evidently due to sunlight scattered by matter in the envelope which was in a state of suspension. The patches corresponded in area to the intersection of the double cone by the envelope, and their thickness was, I may say, insensibly small. Within the envelope, as well as outside, there was none of this scattering. The patches were made more conspicuous by viewing the whole through a cell with an ammoniacal solution of a salt of copper, or through a blue glass coloured by cobalt. In the former case the light from the flame was more weakened than the scattered light, which was richer in rays of high refrangibility; in the latter case the patches were distinguished by a difference of colour, the patches being blue, while the flame (with a suitable thickness of blue glass) was purplish. The light of the patches exhibited the polarization of light scattered by fine particles—that is to say, when viewed in a direction perpendicular to the incident light it was polarized in a plane passing through the beam and the line of sight.

When the beam was passed through the blue base of the flame there was no scattered light. A luminous gas flame showed the patches indicating scattered light like the flame of a candle, but less copiously. They were not seen in a Bunsen flame or in the flame of alcohol, but were well seen in the luminous flame of ether. When a glass jar was inverted over burning ether, the blue part, which does not show scattered light, extended higher, till, just before the flame went out, the luminous part disappeared altogether. A Bunsen flame, fed with chloride of sodium, did not show the phenomenon, though the flame was fairly luminous.

The phenomenon shows very prettily the separation of carbon (associated, it may be, with some hydrogen) in the flame, and at the same time the extreme thinness of the layer which this forms. It shows, too, the mode of separation of the carbon—namely, that it is due to the action of heat on the volatile hydrocarbon or vapour of ether, as the case may be. At the base, where there is a plentiful supply of oxygen, the molecules are burned at once. Higher up the heated products of combustion have time to decompose the combustible vapour before it gets oxygen enough to burn it. In the ether just going out, for want of fresh air, the previous decomposition does not take place, probably because the heat arising from the combustion is divided between a large quantity of inert gas (nitrogen and products of combustion) and the combustible vapour, so that the portion which goes to the latter is not sufficient to decompose it prior to combustion.

In the Bunsen flame fed with chloride of sodium, the absence of scattered light tallies with the testimony of the prism, that the sodium is in the state of vapour, though I would not insist on this proof, as it is possible that the test of scattering sunlight is not sufficiently delicate to show the presence of so small a quantity of matter in a solid or liquid state.—Yours sincerely,

G. G. STOKES.

P.S.—I fancy the thinness of the stratum of glowing carbon is due to its being attacked on both sides—on the outside by oxygen, on the inside by carbonic acid, which with the glowing carbon would form carbonic oxide.

[When the above was written, I was not acquainted with the previous paper by Mr. Burch, published in vol. xxxi. of NATURE (p. 272), nor did any of the scientific friends to whom I had mentioned the observation seem to be aware

[1] Read before the Royal Society of Edinburgh on June 15, 1891. Reprinted from the Proceedings of the Society.

of it. Had I known of it, I should not have thought my paper worthy of being presented to the Royal Society of Edinburgh, as Mr. Burch has anticipated me in the fundamental method of observation.

The reaction mentioned in the postscript is to be taken merely as a specimen of the reactions, on the inside of the carbon stratum, by which the carbon may be re-engaged in a gaseous combination. Carbonic oxide is only one of the combustible gases, not originally present, which are formed during the process of combustion, and are found inside the envelope in which the combustion is going on.—G. G. S., *November* 20, 1891.]

NOTES.

THE annual general meeting of the Institution of Electrical Engineers will be held at the Institution of Civil Engineers, 25 Great George Street, Westminster, this evening (Thursday), at 8 o'clock, for the reception of the annual report of the Council, and for the election of Council and officers for the year 1892. The following paper will be read:—"On the Specification of Insulated Conductors for Electric Lighting and other purposes," by W. H. Preece, F.R.S., Past-President.

THE Royal Danish Academy of Sciences at Copenhagen offers two prizes of 400 and 600 kronen respectively, for investigations on the exact nature and proportions of the more important carbo-hydrates present, at different stages of maturity, in the cereals in most general use; and for investigations on the *Phytoptus* galls found in Denmark, with a monograph on the insects producing them. The prizes are to be awarded in October 1893.

AN improved armillary sphere has been patented by Prof. J. S. Slater, of Calcutta University, which differs from other spheres of the same kind in having a latitude circle to which the celestial sphere is hinged, and in being provided with a movable horizon which adjusts itself to the selected latitude. It can be obtained from Messrs. Walsh, Lovett, and Co., Philpot Lane, E.C.

THE next one-man photographic exhibition organized by the Camera Club will consist of pictures by Mr. J. Pattison Gibson, of Hexham. It will be opened in connection with a concert to be held on the first Monday in January, 1892.

WITH the consent of the Sultan of Muscat, the Survey of India is about to establish a tidal observatory at Muscat. This will probably be followed by the establishment of another observatory of the same kind at Bushire in the Persian Gulf.

WE have had some correspondence with Prof. Arnold about our notice of his speech at the recent meeting of the Institution of Mechanical Engineers. Referring to his remarks on Prof. Roberts-Austen's "Report to the Alloys Research Committee," we expressed the opinion that it was rather straining the prerogative of rhetoric to speak of the work done by Prof. Roberts-Austen as "not worth a rush." We did not intend to imply that Prof. Arnold applied the expression "not worth a rush" to the whole of the work on which Prof. Roberts-Austen reported. He wishes us to state that what he said was, that he thought "any analogue obtained from a comparison of simple bodies like gold and lead with a complex body like steel would not be worth a rush."

THE reports of the examiners on the results of the science examinations held in April and May 1891 have been issued. The examinations related to building construction, naval architecture, mathematics, theoretical mechanics, applied mechanics, magnetism and electricity and alternative elementary physics, chemistry, geology, mineralogy, animal physiology, botany, the principles of mining, navigation and nautical astronomy, steam, the principles of agriculture, and hygiene.

MRS. R. M. CRAWSHAY, writing to us from Mentone, on December 2, about the recent eclipse of the moon, refers to the fact that "the Rev. A. Freeman and Mr. R. T. Leslie are not agreed as to the shadow on the moon's disk having colours or not." For some time there were illuminations and fireworks at Monte Carlo on account of the birthday of the Prince of Monaco, and, when these were over, clouds suddenly came up. "It was only," Mrs. Crawshay says, "when the moon was very nearly half obscured that I caught a glimpse of her without any colouring whatever, orange or otherwise. One could only liken it to a painting in Indian ink."

MR. GEORGE T. BETTANY, who was well-known as a popular writer on scientific subjects, died on December 2 in his forty-second year. For some years he lectured on botany at Guy's Hospital. Conjointly with Prof. Parker, he wrote a work on "The Morphology of the Skull." He was also the author of "The World's Inhabitants," and other books. For Messrs. Ward, Lock, and Co., he edited "Science Primers for the People" and "The Minerva Library."

AN interesting paper on aluminium and its application to photography, by Mr. G. L. Addenbrooke, is printed in the December number of the Journal of the Camera Club. Mr. Addenbrooke thinks aluminium ought now to supersede brass for photographic lenses and the metal parts of cameras. By its use the weight of lenses, flanges, and adapture is reduced nearly to one-third. He is also in favour of aluminium being used for the revolving tripod heads fixed in the bare boards of cameras, as these are rather too heavy in brass. "In hand-cameras," he says, "I think the metal should be useful in most places where there are metal parts. I am also not without hopes that dark slides may be made in it altogether, which will be lighter and more compact than the wooden ones. For developing-dishes, also, it is very suitable, as the action of most of the chemicals used in photography is very slight on it, and when there is any, the compounds formed would not be harmful."

IN his latest communication to the *American Journal of Science* (for November), Prof. Goodale describes his visit to the Queensland Museum at Brisbane, under the charge of Mr. De Vis, rich in specimens illustrating the natural history and ethnology of the colony. An account is also given of the well-known Botanic Garden and Laboratories at Buitenzorg in Java, under the directorship of Dr. Treub, and of the annex on a contiguous mountain; of the Botanic Garden and Experimental Garden at Singapore, under the control of Mr. Ridley; and of the new and at present but poorly developed Botanic Garden at Saigon in French China.

POISONING by mussels is a well-known fact. Such poisoning appears in chronic form in Tierra del Fuego, mussels being abundant on the shores, and other kinds of food rare, so that the natives eat large quantities of the former daily, both of bad and of good quality. According to a doctor of the Argentine fleet, M. Segers, the mussels are rarely injurious at their maximum time of growth, which corresponds with full moon, but when the moon wanes, they become poor and often poisonous. The poisonous quality apparently results from the death of a large number at this time, and the putrefaction of their bodies yielding ptomaïnes which are absorbed by the surviving mollusks. In any case, the Fuegians are often attacked by a liver complaint, consisting in atrophy of the organ, with jaundiced colour of the skin and tendency to hæmorrhage; and M. Segers believes this is due to mussel poisoning. He finds sulphate of atropine an efficacious antidote.