of masses. In the course of a communication which I made to the Physical Society of London, at their last meeting, I appealed to the Fellows present to supply me with the missing phrase. In the discussion which followed the paper, this matter was only incidentally referred to; but, although I think that there was a general agreement as to the want, unfortunately the meeting closed without coming to any conclusion as to the best method of supplying the deficiency.

Will some of your readers help me in this matter?

12 Park Side, Cambridge. E. H. GRIFFITHS.

The Swallowing of One Snake by Another.

THE snake incident, described in NATURE, October 25 last, page 620, as having occurred in the reptile-house in the Zoological Society's menagerie, recalls to my mind two similar cases, recorded in the same periodical, vol. xxx. July 3, 1884 ("A Cannibal Snake," by E. H. Evans), and July 31, 1884 ("The Swallowing of One Snake by Another," by C. R. Osten-Sacken). The first case was observed in Java, the other was witnessed by me in Washington, D.C. In the latter case one of the snakes, although three-quarters of its length had already been engulfed in the other, succeeded in getting out, apparently unharmed, as it remained alive and well in the cage a long time afterwards.

In the *Figaro*, July 26, 1894, I found still another instance of the same kind, which happened in the Jardin d'Acclimatation in Paris. A large snake, while attempting to swallow a rabbit, was interfered with by another one, and passed with the rabbit into the body of its comrade of captivity ("L'un des deux passa à la suite du lapin dans le corps de son camarade de captivité").

C. R. OSTEN-SACKEN.

Heidelberg, Germany, October 28.

ON RECENT RESEARCHES IN THE INFRA-RED SPECTRUM.¹

I PRESENTED to the Association in 1882, at Southampton, an account of some researches made by means of the bolometer, in the infra-red spectrum, formed by a glass prism; but though these labours have continued with occasional intermission during the past twelve years, it is for reasons, which will be explained later, only within the past three years that any notable advance has been made, and only within the past twelvemonth that such a measure of success has been attained as justifies the present communication.

This is not the time to give any historical account of discovery in the infra-red, but all those interested in the subject know that the first investigator here was Sir William Herschel, whose observations consisted essentially in finding that there was something which the eye could not see in a region which he proposed to call the "thermometric spectrum." His distinguished son, Sir John, made a curious anticipation of later discovery by indicating, though crudely, that this invisible heat was not uniformly distributed, and a similar conclusion was reached in an entirely different manner, through the thermopile, by the too early lost Melloni. So ignorant, in spite of these investigations, of those of the elder Draper and of the elder Becquerel, were we till lately, that when, quite within my own recollection and that of most of you, Lamansky in 1871 published, from his observations with the thermopile, a crude little illustration showing three inequalities in the energy curve, universal attention was excited by it among those interested in the subject.

Among other minds my own then received a stimulus which turned it in this direction, and having, as it seemed to me, exhausted the capacities of the thermopile, I invented an instrument for continuing the research, which was afterwards called the bolometer, and with which, in 1881, at an altitude of 13,000 feet upon Mount Whitney, I found spectral regions hitherto unreachd, and whose existence had not been suspected.

I returned with a strong impression of the prospective importance of this discovery, and laboured at the Allegheny Observatory in improving all portions of the new method of research, especially of the bolometer and its adjuncts, with the twofold object of obtaining greater sensitiveness to heat, and greater precision in fixing the exact point in the spectrum where the change of heat originated. With the former object such a degree of sensitiveness was at that time reached, that the bolometer indicated a change of temperature of $\frac{1}{100,000}$ of a degree Centigrade, and with the latter, such precision that it was possible to fix the relative position of a line, not merely with a possible error of a considerable fraction of a degree, such as Lamansky's determination is evidently subject to, but with a certainty that the error would be within a minute of arc. The range of the apparatus in wave-lengths was almost unlimited as compared with any other process, and both its sensitiveness and its possible precision seemed to be at that time notable as compared with previous methods, for a great advance was made on anything done before with the thermopile, when the presence of the well-known "D" line of sodium was rendered sensible (though barely sensible), even as a *single* line, by the change of temperature. The sensitiveness was also, as has been said, accompanied with the possibility of unusual precision. The results of this labour were laid before the British Association in the communication already alluded to, and which exhibited ten or twelve inflections of the curve in the portion till then almost unknown, which extends from a wave-length of 1μ to a wave-length of nearly 3μ , at which point the glass prism then used became wholly opaque to radiation. The positions of these inflections were fixed with a precision quite impossible to the thermopile, but this exactness was only obtained in practice by a process so slow as to be almost prohibitory; and with this apparatus the writer personally made in those earlier years such a number of observations as he hardly likes to recall, so disproportionate did the labour inherent in this method seem to the final result.

The justification of this labour seemed to lie in the fact that it does not appear that photography has ever rendered anything much below a wave-length of 1μ —anything, at least, which has been reproduced for publication in a way which gives confidence that we are in touch with the original. The processes which involve the use of phosphorescent substances have given some indications of lines considerably below 1μ , but it is safe to state that the work which has just been referred to as communicated to this Association in 1882, presents almost the only indications which we have possessed, even up to the present time, about the lower infra-red solar spectrum.

Now the curve which was given, even in the later Allegheny observations made with the rock-salt prism, contained but a dozen inflections below the wave-length of 1.5μ , and these inflections, with their correct prismatic and wave-length positions, represent, I think, most of our present knowledge in these regions even to-day.

To understand the method by which there were attained, but only at this great cost of labour, results till then unreachd, it may be repeated that the bolometer had been rendered more sensitive than the thermopile, but that it was capable of being pointed and its position in the spectrum being measured, only by a tedious process which has been exclusively used till lately (but which that presently to be described advantageously replaces). Whichever process is used, when the bolometer thread touches a cold line in the spectrum (since what is black to the eye is cold to it), a larger current flows through the galvanometer, and the spot of light marking the needle's motion is deflected through a certain number of degrees.

From this point forward, the new process, whose results I am about to have the pleasure of bringing before

¹ A paper read to Section A of the British Association, at the Oxford meeting on August 11, by S. P. Langley.