dition of the people. A number of pages are taken up with a description of an ideal water-supply and methods of drainage, great stress being laid on the necessity for laying down drains and sewers of the smallest possible size consistent with the immediate removal of the maximum flow at any one time. The wisdom of such a plan is now admitted on all hands, the powerful flow preventing all deposit, and by maintaining a down draught from the houses, avoiding the ingress of sewer-gas.

In the section on "Health in the School," we find an account of the "Half-time System" initiated by Sir E. Chadwick with the object of ensuring to children employed in manufactories a certain time for school-work and recreation, in addition to that devoted to physical labour. The time which should be occupied by lessons at various ages, and the effect of good lighting, warming, ventilation, and personal cleanliness in augmenting the receptivity of pupils, are ably discussed, and the value of military drill as a part of the education is rightly insisted on. The methods for the prevention of the occurrence and spread of epidemics are so briefly touched upon, that we cannot but think that the importance of the subject might have demanded somewhat fuller treatment.

The most important portion of the following section deals with the results of occupation and surroundings on the length of life in various classes of society, the effects of intemperance and of bad feeding being specially considered; the author, however, being careful to point out the sources of fallacy to which all such statistics are liable. The last portion of the book is mainly devoted to an attack on the Malthusian theory.

The work is not, and does not in any way pretend to be, a student's text-book, so that the candidate for a diploma in public health will hardly find it of much value, except, perhaps, from an historical point of view. Still, there is much in its pages which may be studied with advantage by those interested in matters pertaining to general hygiene, especially as it presents in moderate compass a most readable account of the labours of a distinguished pioneer in the field of sanitary science.

OUR BOOK SHELF.

Induction and Deduction, and other Essays. By Constance C. W. Naden. Edited by R. Lewins, M.D. (London: Bickers and Son, 1890.)

THIS little work acquires a melancholy interest from the fact that the talented young authoress has not lived to see its publication. The title essay, on "Induction and Deduction," gained in 1887 the Heslop Memorial Medal, provided out of the proceeds of a bequest to the Mason Science College of Birmingham by the late Dr. Heslop, and awarded annually by the Council of the College. It is clear, concise, well-arranged, and carefully thought out; and leads one to believe that, had the hand of Death been withheld, Miss Naden would have made valuable contributions to philosophic thought. For Miss Naden the fundamental principle in philosophy is the famous Protagorean formula of relativity, that "Man is the measure of all things, of things that are that they are, of things that are not that they are not." She insists on the close inter-connection of induction and deduction in all reasoning, the two processes not being antagonistic but complementary. Both involve cognition and recognition; but whereas induction is a process of cognition involving recognitions, deduction is a process of recogni-

tion involving cognitions. The historical development is traced from the Greek cosmologists, through Plato, Aristotle, Bacon, Descartes and Locke, Mill, Jevons, and J. H. Green; and there are many signs that Miss Naden had not merely grasped but assimilated the teachings of those whose influence on the theory of reasoning she traced.

That Miss Naden was not wanting in humour is seen from the "Legend of the Inductive Method" in her introduction. This is so good as to be worth quoting.

"In the beginning was a set of philosophers, who, instead of looking about them, simply investigated their own thoughts, and tumbled into many ditches, not so much through star-gazing, as through mind-gazing. Out of their inner consciousness they extracted a great many principles which were inapplicable to Nature, and were therefore of none effect; and on account of this wilful perversion they failed to invent the steam-engine or to discover the circulation of the blood. This state of things went on for a long time; and in the Middle Ages matters grew worse rather than better; for now there appeared a set of men called schoolmen, who submitted everything to the authority of the Church and of Aristotle, and wasted their time in frivolous debates about phantoms named quiddities and hocceities and haecceities. Their method also was deductive, and was false. But in the glorious sixteenth century, and in our own glorious island, there arose a Lord Chancellor who wrote a book which changed the face of the intellectual world. This great man found out that the proper office of the mind is to make discoveries, and that the proper way to make discoveries is to interrogate Nature. He laid down rules for the correct framing of our interrogations. He is the father of all such as make far places near by steam-engines and electric telegraphs, or numb our pain by anaesthetics, or light the world by gas or electricity. His method is called inductive, and is true."

The other essays are on ethical and sociological questions, and on "Hylo-Idealism: the Creed of the Coming Day." They are somewhat unequal in value. The work is prefaced by a short memoir. C. LL. M.

The Lepidopterous Fauna of Lancashire and Cheshire. By John W. Ellis, M.B. (Vic.), F.E.S. (Leeds: Printed by McCorquodale and Co., 1890.)

THIS volume, the contents of which are reprinted from the *Naturalist*, will be of great service to all students of the subject to which it relates. Dr. Ellis does not offer his list as conclusive; but he has "endeavoured to present, as completely as possible, the facts known with reference to the occurrence in Lancashire and Cheshire of the British species of Lepidoptera." The list is preceded by a short statement as to the geological and meteorological conditions which, by affecting the flora of the district, affect indirectly its lepidopterous fauna.

LETTERS TO THE EDITOR.

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. No notice is taken of anonymous communications.]

Intelligence of Chimpanzees.

ONE is glad to see that your review of Mr. Stanley's book calls attention to the following statement, which is made on the authority of Emin Pasha, and rendered in his own words:—

"The forest of Msongwa is infested with a large tribe of chimpanzees. In summer-time, at night, they frequently visit the plantations of Mswa Station to steal the fruit. But what is remarkable about this is the fact that they use torches to light the way! Had I not witnessed this extraordinary spectacle personally, I should never have credited that any of the Simians understood the art of making fire."

On this passage your reviewer remarks:—"We cannot doubt

the accuracy of Mr. Stanley's report, nor the trustworthiness of Emin's observation; but we should like to have more details." But as Emin himself allows that he would never have credited the fact alleged had he not witnessed it personally, we may, perhaps, without discourtesy, refuse to accept so bald a statement of "this extraordinary spectacle." Of what were the torches constructed? How do these "Simians" practise "the art of making fire"? Having once acquired the art, do they use it only for the purpose of making "torches to light the way"?

Speaking for myself, and not without some knowledge of the intelligence of a chimpanzee, I confess that, until at least these "details" are supplied, I do "doubt the trustworthiness of Emin's observation," and I shall be satisfied to suppose that, owing to a shortsightedness of which we have heard so much, the Pasha has mistaken a band of native children for his "large tribe of chimpanzees."

GEORGE J. ROMANES.

July 6.

Dr. Koenig's Theory of Beats.

I MADE an experiment, some years ago, which would seem to support and illustrate Dr. Koenig's theory of beats, as set forth by Prof. Silvanus Thompson in his lecture before the Physical Society, and reported in your issue of June 19. Taking two tuning-forks, each of which gave the middle C (256 vibrations), I weighted one of them so as to make it give one beat a second when sounded with the other. Then, sounding this fork, so weighted, with another giving the fifth above, G (384 vibrations), I heard distinctly three beats a second. I could only account for these beats by assuming that the weighted fork C produced a feeble twelfth, and that the fork G produced a feeble octave. These two overtones would, if present, give three beats a second, $255 \times 3 = 765$, and $384 \times 2 = 768$. But I could not show by any independent evidence that these overtones are really present when the tuning-forks are sounded; and, in fact, the general opinion is against such an assumption.

If, however, Dr. Koenig's theory be accepted, the beats are easily accounted for. According to his view, as stated by Prof. Thompson, these forks when sounded together would yield two sets of beats, called, respectively, *superior* and *inferior*; and each set of beats would blend into a musical tone. Thus we should get—

Inferior beat	384 - 255 = 129
Superior beat	510 - 384 = 126

These primary beats, or beat-tones as they may be called, of 129 and 126 vibrations would act as independent tones, and produce secondary beats of three in the second.

I hope Prof. Thompson's paper will be published in full, that we may all have an opportunity of considering the details of Dr. Koenig's reasoning; but, in the meantime, I thought the experiment I have described would be interesting to your readers, as it is very easily made. Perhaps I should add that the experiment succeeds equally whether the forks are mounted on resonance-boxes or not; and therefore the effect cannot be ascribed to the boxes.

GERALD MOLLOY.

Catholic University, Dublin, June 22.

The "Night-shining Clouds."

I HAVE not yet seen, in any English publication, mention of the important results of the more recent researches of Herr O. Jesse and his coadjutors on these clouds. By taking simultaneous photographs from two or more widely separated places, the height of the clouds has been determined with great exactness. On July 2, 1889, this was found to be somewhat over 80 kilometres. The operations have evidently been conducted with great care, and the results may therefore be fully trusted. The question is therefore set at rest as to whether the clouds are self-luminous, for it is evident that at such a height their brightness is fully accounted for by the sun shining upon them. In 1886, Herr Jesse had, upon this supposition, ascertained their brightness to be from 49 to 54 kilometres, and that the lower the sun descended the smaller was the illumination needed to show them as the atmosphere darkened, so that the calculated height increased with the sun's depression below the horizon. Some people were incredulous about the great height at that time attributed; but the photographs give them a yet greater elevation, which places them quite out of the category of any ordinary clouds. Those who have not seen the photographs may query as to the possibility of identifying the

same points in the two photographs compared, and may think that even synchronous photographs might show very different details by being taken from two distant stations; but, on the contrary, in those examples I have seen, the two photographs are so exactly alike that it is very difficult to discover any difference whatever between them, though taken at Nauen and Steglitz, 35 kilometres apart, which consideration of itself shows the enormous height of the clouds. In some of the photographs the stars α and β Aurigæ are distinctly visible.

The letter by "M. E." (p. 198) evidently describes an apparition of these clouds on the night of the 17th ult., when, as I am informed, they were also seen from Sunderland; but I have not myself seen them either this year or last, though they have been seen both years in Germany—more especially after midnight. They generally are seen in June and July, the earliest recorded date being May 26, and the latest August 11.

Sunderland, July 8.

T. W. BACKHOUSE.

IN a letter which you published some time ago on "night-shining clouds," there was a request for notes of their occurrence. It may, therefore, interest some of your readers to know that they were well seen here on the evening of the 4th inst. They appeared rather suddenly shortly before 10 p.m., covering the sky from N. to N.E., and from the horizon for about 15° up. They were not in regular strata, but scattered in all directions, like cirrus after a storm. About midnight they were still visible, but more to the left, some being west of north. The first time I saw these clouds was on June 18, 1886, soon after midnight, when they were about N.W., and 20° from the horizon, and since then they have often been seen; but never, so far as I know, with the storm-tossed appearance they presented last week.

CECIL SHAW.

Belfast, July 7.

A VERY fine display of luminous night-clouds was visible here during the night of the 4th inst., the luminosity extending to an altitude of 30° above the northern horizon, ending above in definite cirrous streamers, or cloud wisps. It will be seen by the Ben Nevis June Summary that these clouds were noted on the 29th ult. In NATURE of the 3rd inst. (p. 222), the writer's communication on this subject was misprinted Kensington instead of Kingstown (Co. Dublin). The present dates from Scotland.

Aberdeen, July 7.

D. J. ROWAN.

An Electrical Effect.

IT may be of value to remind teachers of an effect not generally known, which is produced by varying the ordinary mode of performing the experiment of putting pieces of zinc and silver in the mouth and touching them, to obtain the acid taste which accompanies the completion of the electric circuit.

If the piece of zinc be placed under the tongue, and a florin vertically between the upper lip and the top row of teeth, and the two metals be brought in contact, a faint flash is seen in both eyes when the eyes are open.

If the eyes are shut the sensation of light is not felt, so that the effect is probably due to a muscular twitching.

It is necessary to use a large silver coin, and not a shilling, and to push it well home behind the upper lip.

The experiment so made seems to be a handy and simple illustration of the meaning of subjective phenomena.

Clifton College, July 7.

EDWARD B. COOK.

THE PHOTOGRAPHIC IMAGE.¹

THE history of a discovery which has been developed to such a remarkable degree of perfection as photography has naturally been a fruitful source of discussion among those who interest themselves in tracing the progress of science. It is only my presence in this lecture theatre, in which the first public discourse on photography was given by Thomas Wedgwood at the beginning of the century, that justifies my treading once again a path which has already been so thoroughly well beaten. If any further justification for trespassing upon the ground of the historian is needed, it will be found in the circumstance that in the autumn of last year there was held a celebration

¹ Friday Evening Lecture delivered at the Royal Institution by Prof. Raphael Meldola, F.R.S., on May 16, 1890.