probably be a difference of temperature between the coils, and the mean would be taken. On testing the matter, however, no such difference was found, even up to the highest temperature used, 250° C. If any difference existed it was less than one-tenth of 1° C., as that amount could have been measured. This being the case in a narrow tube where the air circulation was hindered by a number of mica discs (see *Physical Review*, February 1893, for description of apparatus), it is improbable that there is any appreciable difference when there is no hindrance to the air currents except the heating coil of platinum.

I have never used the apparatus for very high temperatures, but see no reason why it should not be so used; and it would apparently present a number of advantages for such work, chief among which is the fact that the temperature would be obtained by direct comparison with an air or nitrogen thermometer, and no assumptions made as to the law of variation of thermo-electric force with temperature.

It can, of course, be made self-recording by placing a recording pressure gauge in place of the mercury column, the observer simply keeping the galvanometer at zero by manipulation of the carbon resistance.

It is obvious that platinum resistance coils can be used instead of the thermo-junctions, the platinum resistance coils forming two arms of a Wheatstone bridge, and the galvanometer placed across them.

A method of measuring the heat conductivity and temperature coefficient of metals devised by me, and at present being used by one of my students, may be of interest. A metal bar, well annealed, polished, and with special precautions taken to preserve homogeneity of physical state, has its ends placed in two mercury baths, A and B. The bar is protected from radiation by concentric polished metal tubes. A is heated electrically, and B cooled by a water tube. In the regular laboratory exercise, I have been in the habit of letting the students use thermometers. But in this case, where accurate results are required, capillary tubes are led off from A and B, filled with mercury, thus forming a thermo-junction. Another thermo-circuit has its junctions placed at the entrance and exit of the cooling water. It would, of course, be possible to measure the thermo-voltage directly by standard cell; but instead of this, in the present method, the two thermo-circuits are balanced against one another, the elements which are immersed in the water being chosen so as to have a much higher thermo-voltage than the copper-mercury couple. It is seen, without much difficulty, that by this means the conductivity of the copper may be measured without knowing more than one temperature, and that only approximately, to a considerable degree of accuracy. As the experiments are not concluded, I am unable to state definitely what the value of the method is, but the indications are that it will prove successful. REGINALD A. FESSENDEN.

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On Crookes' Spectrum of Helium.

IN his investigation on the spectrum of helium,[1] Crookes has examined the spectrum of five different samples of gas, two being developed from cleveite (No. 1 and No. 5), another from uraninite (No. 2), and two from bröggerite (No. 3 and No. 4). Sample No. 5 has been prepared with special care, and is designated "helium purissimum." The five spectra are by no means identical, and it has been concluded that besides helium there are other gases present. E. A. Hill[2] has even gone so far as to infer the existence of at least fifteen new elements from the comparison of these five spectra. Thirty of the seventy-nine wave-lengths measured by Crookes coincide (within the limits of error) with wave-lengths that we have measured in the spectrum of cleveite gas.[3] But the remaining forty-nine lines, many of which are strong, do not coincide with any of ours. As far as we know, it has not been noticed that thirty-three of these forty-nine lines almost certainly belong to argon, among them nearly all the stronger lines. Six more may also be argon lines, but the identification is rather doubtful. Two lines in all probability are mercury lines, which naturally are likely to appear in a vacuum-tube made by means of a mercury pump. One line may be due to carbon. The table on p. 246 contains a list of the forty-nine wave-lengths that do not coincide with wave-lengths that we ascribe to helium, and gives their probable origin. The wave-lengths of argon lines are taken from Kayser (*Chemical News*, August 30, 1895), Eder and Valenta (*Ber. der Wiener Akad.*, October 24, 1895), and from Crookes' own measurements.

3890·5 and 3885·9 are strong lines that have been seen in the spectra of all five samples. Crookes considers them as satellites or components of the strong line between them, the wave-length of which is 3888·785 according to our measurements. But as our photographs show that this line is single, or if not single has a weak component 0·05 lower, which can only be observed with much greater dispersion than Crookes has used, we are inclined to believe that 3890·5 and 3885·9 are spurious lines due to some error of apparatus having made their appearance on account of the enormous energy of 3888·8.

Of the five remaining lines, three are only of intensity 2. The two stronger ones have only appeared in the gas from uraninite, and may possibly belong to a substance hitherto unknown. But it is far from being established.

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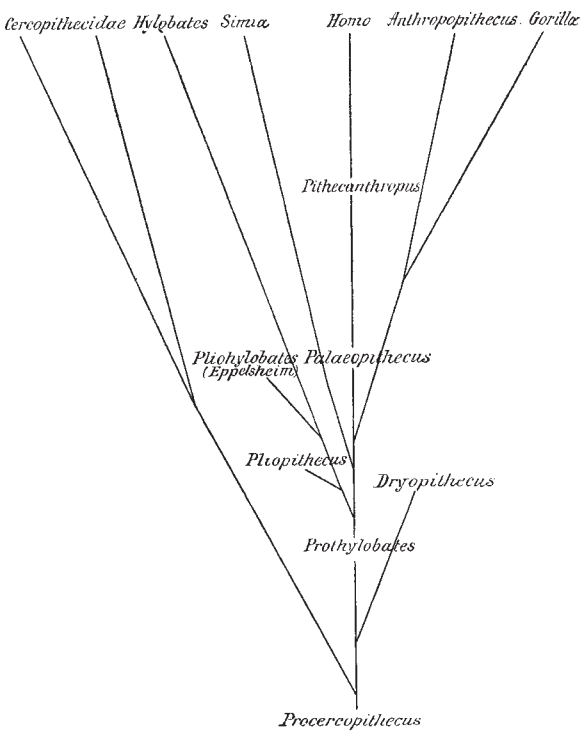
[1] *Chemical News*, August 23, 1895. reprinted in NATURE, August 29, 1895.

[2] *American Journal of Science*, November 1895.

[3] *Berichte der Berl. Akad.*, July 1895. See also NATURE, September 26, 1895,

The Place of "Pithecanthropus" in the Genealogical Tree.

IN the report on the scientific meeting of the Royal Dublin Society on November 20, in NATURE of December 5, 1895, it is stated that I placed Pithecanthropus in the genealogical tree, drawn by Prof. Cunningham, below the point of divarication of the Anthropoid apes from the human line. This indeed I did. But this statement could be misleading as to my real views on the genealogy of Pithecanthropus, such as I stated them already on p. 38 of my original memoir ("*Pithecanthropus erectus*, Eine menschenähnliche Uebergangsform aus Java," Batavia, 1894), and more fully at the last meeting of the Anthropological Institute of Great Britain and Ireland, on November 25.



It may not be superfluous to explain my views here by means of the accompanying diagram, representing the evolution of the Old World apes from a hypothetical common ancestor, whom I call Procercopithecus.

In Prof. Cunningham's tree, figured in NATURE of December 5, p. 116, he regards the left branch as all human, the right one as entirely simian, and he placed Pithecanthropus midway between recent Man and the point of divarication.

	Intensity. Sample No.					Sample not specified.	Argon. Red.				Argon. Blue.			
	1	2	3	4	5		Crookes.	Int.	Eder and Valenta.	Int.	Crookes.	Int.	Kayser.	Int.
5062·15						3					65·	10	·258	2
4931·9 *a*						3								
4870·6 *b*		7												
4847·3		7							·95	3			·965	3
4805·6		9				2			6·10	5			6·185	6
4764·4 *c*									4·99	4			5·030	3
4735·1		10							6·03	6			6·069	5
4658·5		8							8·01	4			·070	4
4579·1		3							·49	3			·531	5
4559·4						2								
4544·1						5			5·28	4			5·231	5
4520·9		3							2·45	8				
4511·4		5					09·5	9	10·83	10	09·5	8		
4497·8						2			8·62	1			8·874	1
4437·1						1							9·541	1
4428·1		10							30·35	4	26·5	10	30·365	6
4424·0		10							6·15	6	22·5	10	6·170	9
4399·0 *d*		10							01·17 00·20	5 3	99·5	10	01·165 00·269	5 3
4378·8		8							9·79	4	76·5	9	9·832	6
4371·0		8							1·46 0·89	3 2	69·0	9	1·504 0·921	4 4
4348·4		10							·11	8	48·5	10	·231	10
4333·9		10					33·5	9	·64	10	33·5	9	·701	2
4298·7		5					00·5	9	00·18	10	99·0	9		
4281·3		5											3·084	3
4271·0		5					72·0	8	2·27	10				
4258·8	7	7	7	7	7		59·5	9	9·42	10	59·5	8		
4227·1		5							8·30	4			8·301 7·142	5 2
4198·6	Very faint	9		Very faint			98·0	9	00·76 98·42	10 10	98·0	9		
4189·9	Very faint	9		Very faint			91·5	9	91·15 90·76	6 6	91·5	9		
4181·5	Very faint	9		Very faint			83·0	8	2·07	9	83·0	8		
4178·1						1							9·478 8·477	1 1
4157·8		8	Veryfaint	Very faint			59·5	10	8·63	10	59·5	10		
4044·3	Present	Present	Absent	Absent	Absent	9	44·0	9	4·56	8	44·0	8		
4012·9	7	7	7	7	7				3·97	4	13·0	8	3·997	6
3962·3 *e*	4	4	4	4	4								0·620	2
3948·2	Very faint	10					48·5	10	9·13 7·70	10 5	48·5	9		
3917·0 *f*					2									
3913·2 *g*	Absent	Present	Absent	Absent	Present	4							4·918	3
3890·5	9	9	9	9	9									
3885·9	9	9	9	9	9									
3874·6		6											5·413	3
3800·6 *h*					4								3·383 0·429	2 1
3642·0		8									3·27	3		
3627·8		5												
3247·5 *i*					2									
2536·5 *j*					8									
2479·1 *k*					4									
2446·4 *l*					2									
2419·8					2									

The only lines that certainly remain not accounted for, leaving aside those where the coincidence is not very satisfactory, are :

4870·6		7												
4559·4						2								
3917·0					2									
3890·5	9	9	9	9	9									
3885·9	9	9	9	9	9									
3627·8		5												
2419·8					2									

a There is an argon line at 4933·4 stronger in the blue spectrum seen on our own plates, but not mentioned by Kayser nor by Crookes. Crookes gives 4938 int. 10 as a line of the blue spectrum of argon. But as there is no strong line at 4938, we are inclined to think that it is meant to be 4933. *b* The deviation is too great to suggest the argon line 4879 (Crookes), though its intensity is about the same as that of 4848, and would therefore suit very well. *c* Schuster has also measured these lines, and gives them, together with 4879 and 4726, as characteristic argon lines of the spectrum at atmospheric pressure. *d* H. F. Newall, experimenting with one of our vacuum tubes filled with cleveite gas, found that these five lines appeared in the periphery when it was put into a coil through which the discharge of a Leyden jar passed. We could not detect the lines on photographs taken with an induction current passing through the tube in the ordinary way. *e* Coincidence very uncertain. *f* H. F. Newall gives a line 3918·8 int. 5,* but at this place there is no argon line on our photographs. *g* Coincidence doubtful. *h* Coincidence doubtful. *i* We see a line in the blue spectrum of argon at 3248·4 on our plates. *j* 2536·65 strong mercury line. *k* 2478·66 strong carbon line. *l* 2446·96 mercury line, intensity 6.

* *Astrophysical Journal*, May 1895.

Now I could find no place for the fossil Javanese form, which I consider as intermediate between Man and Anthropoid apes, in any of the branches of *that* tree, only in the third chief line, the main stem, very near to the point of divarication.

Owing to the same circumstances, which indirectly prevented me from explaining my own views on the matter at Dublin, I did not then reply to two remarks of Prof. Cunningham, which omission I now wish to repair by the following declaration.

(1) I did not exaggerate the relative height and quality of the cranial arch, which Prof. Cunningham had in view (the arch of the glabella-inion part of the calvaria) in Hylobates. The profile outline of the skull of *Hylobates agilis* figured, directly from the bisected skull, on p. 8 of my memoir, is even somewhat higher than that of Pithecanthropus, of which I have an accurate bisected cast before me. In the latter the height of the said cranial arch is exactly equal to the one-third part of the glabella-inion line, and in the skull of a *Hylobates agilis* it is about 2 mm. higher than the third part of the corresponding line. If in the mentioned diagram in my memoir that line in the gibbon skull were drawn equal in length to that of the fossil calvaria, instead of the natural size, this would be more apparent there than it is even now. The said cranial arch of a *Hylobates syndactylus* in the same diagram is much lower than that of the other gibbon species, and the same arch in the chimpanzee would even be lower than in *Hylobates syndactylus*. It is easy to find skulls of Semnopithecus with a higher "cranial arch" than the chimpanzee has. Further, between different individuals of the same ape species and of man, we find great differences in the height of that arch.

All these facts tend to show that there is no reason for regarding the height *of the suprainial part* of the calvaria as of real importance in our judgment on the place which any human-like being should occupy in the genealogical tree.

(2) In my original memoir (p. 7), I have already pointed out that the occiput of the fossil skull is very ape-like, especially gibbon-like. But, nevertheless, the inclination of the planum nuchale on the glabella-inion line is very different from that of all the Old World apes. These accord very nearly with one another in the degree of this inclination, whilst the angle in Pithecanthropus approaches closely human conditions. I not only compared photographs of the median line of the skulls, but also the bisected skulls with the bisected exact cast of the fossil calvaria. The means which I have taken to determine the degree of this declination are therefore, I believe, entirely calculated to yield trustworthy results. EUG. DUBOIS.

An Anagram.

Is it too frivolous to suggest the accompanying anagram?

Pithecanthropus erectus.
Pursue the person, catch it!

Kew, December 10, 1895. E. H.

The Barisal Guns and Similar Sounds.

WITH reference to the letters that have appeared in NATURE on the above subject, I have read with interest that by Mr. G. B. Scott, of the Indian Survey, in your last issue. The question, I think, arises, Are we not dealing, in India at least, with two very different phenomena? Are these sounds like that of heavy ordnance, which are heard occasionally at the base of the Eastern Himalayas and the Garo and Khasi Hill Range,[1] the same as those longer known and more familiar as the "Barisal Guns"? Mr. Scott's description of the sounds he heard when on board the steamer moored in the narrow channels near the sea, are remarkably like wave action. He says: "Sometimes a single report, at others two, three or more in succession, never near, always distant, but not equally distant. Sometimes the reports would resemble cannon from two rather widely separated opposing forces, at others from different directions but apparently always from the southward, that is, seaward." This is precisely what one would hear on a still night, when an ocean swell was coming up the Bay of Bengal and breaking all along a low shore with an undulating outline stretching many miles east and west.[2] I have been twice round by Barisal in a river steamer, and once by native boat, which took many days; but I was not fortunate enough to hear the sounds.

Regarding the distant booming reports, that are heard further inland, I was, I think, one of the first to notice and put them on record. In the *Proceedings* of the Asiatic Society of Bengal, March 1869, *vide* "Notes from Asaloo, North Cachar, on the Great Earthquake of January 10, 1869," after giving some details of the daily shocks that were recorded up to the 17th of that month, I find the following on p. 98. "Very noteworthy is the distant report of a heavy gun on January 19, heard towards the west at 1h. 49m. 19s. p.m. (I was sitting at work at a table outside the office tent); the time I took immediately by chronometer, as I fully expected a shock to follow. Another very loud explosion was heard from Mahadeo Peak at midnight of the 29th, and again from the same peak at 7 a.m. the next morning, the 30th; but no shock came after, on either occasion.

"I may here mention that last cold weather, on several occasions when I was in the North Cachar Hills, I heard, at various times, the like distant reports, resembling exactly the firing of big guns at a great distance. In one or two places the country people had noticed it, and they even used the expression that it proceeded from the earth (*the earth speaks*).

"These subterranean explosions must be heard over large areas, and it would be interesting if they could be noticed, or rather if those hearing them would make the matter public; I have no doubt there are many individuals who will remember having heard such sounds." The reports like big guns, "top chalta," as the natives expressed the sound, heard at Asaloo in January, during a period of great seismic activity, were, I consider, intimately connected with it; and that the similar reports, solitary instances not continuous, heard in the previous year at different places in the same range, were also of a subterranean nature. Seismic sounds are not always accompanied by a disturbance of the earth conveyed to the senses. I find in my journal the following.

"*Nongtung, in Jaintia Hills, December* 21, 1887."

"While seated at dinner, a curious rumbling sound was heard in the west. Mr. Ogle immediately said, 'that is the rumble of an earthquake,' and we waited with intense expectation for several seconds for the shock, I with my watch out ready to take its duration; but it never came. We then thought it might have been a herd of elephants coming up the ridge, and, disturbed by our camp fires, had rushed off through the jungle; but on going into Jawai on Christmas Day, we learnt that a shock had been felt there on the same date and time, and that it apparently came from the west."

The best-defined unaccountable sound occurred when I was surveying the Bhutan Dooars in the spring of 1865. I have some remembrance of putting it on record at the time, perhaps in my annual report. I was standing at the plane-table in the forest twelve miles south-west of Buxa, when the report of a heavy gun was heard in the direction of the mountains, clear and distinct, yet a long way off, followed closely and at irregular intervals by two other discharges. The natives with me immediately said "the Bhutias have attacked Buxa," which was not unexpected, for they had only lately retaken Dewan Giri. A short time after, on reaching the main path from Buxa to Balla, an irregular cavalryman of the Jat Horse came by, carrying despatches for Buxa Fort. I wrote a hasty note to an officer there to ask what was going on, and I received in due course a reply saying not a shot had been fired there or anywhere else. These reports were louder and more distinctly like artillery fire than any I afterwards heard in the hills further to the east. These last had the nature of a very, very distant boom, coming from no well-defined direction. Particularly do I recall one occasion when we were going down a narrow spur on the southern face of the Jaintia Hills, on a glorious fine day, the view over the basal slopes all clothed in forest, and the plains and low hills of Sylhet beyond fading into the high horizon of the delta of the Brahmaputra. The sound seemed to come from out of the distance along the foot of the mountains—west and south.

As a primary cause, every possible kind of force has been suggested—fireworks, *i.e.* bombs, cannon, bursting bamboos in jungle-fires, thunder-claps, landslips, and the falling of river-banks. I am familiar with the sounds produced by all these causes, and the last-named was particularly brought under my notice when proceeding by boat on the Megua and Brahmaputra, and from Gowhatty on a raft made of two dug-out canoes to Doobri, 125 miles. I have often seen and heard the report which

[1] *Vide P. A. S.* Bengal. Mr. La Touche, of the Geological Survey, p. 201, in "Report on Barisal Guns."
[2] *Vide* same Report. Letter by Mr. A. Manson, p. 208.