history referred only to its general educational and logical bearings. Natural history as dealing with that domain of Nature to which man himself belongs had received no serious consideration by him. Only since his time, and to the extent that man has accepted the theory of 'descent with modification' as applying to his own origin and nature, has it been possible for anybody to see that if ever man is to attain that measure of self-knowledge after which the wisest ones of all races have longed and striven, that knowledge must partake much more of the character of 'natural science' than of 'exact science', using these terms as they are now largely understood.

The following then is suggested as one opportune subject for treatment at such a conference as that proposed by Prof. Donnan: The ancient injunction, Know Thyself, may be placed on a scientific-philosophic basis by developing to its fullness the partial insight gained by William Whewell of a natural history mode of philosophising. W. E. RITTER.

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Oct. 9.

Ancient Metallurgy in Rhodesia.

MY attention has been directed to an article on "Early Man in N. Rhodesia", by Prof. Raymond Dart, which appeared in the *Times* of Aug. 22 and was noticed in NATURE of Aug. 30. Echoes of the statements made in the article are finding their way into our local Press, and the unprotected public is being told that iron was being fabricated "3000 to 4000 years" ago by a people of Palæolithic culture dwelling in central Africa.

On the face of it, such an accomplishment is highly improbable, because the oldest man-made iron of known date is that of the discovery made by Sir Flinders Petrie at Gerar, in Palestine, in 1927. The date of this iron, as determined by associated scarabs and amulets, is 1350 B.C. It is probable that the smelting of iron was begun a little earlier, say, 1400 B.C., in the Hittite uplands, between the Taurus and the Caucasus, a region to which classical tradition points as the cradle of metallurgy. All iron earlier than 1400 B.C. is probably of meteoric origin; many older relics have been tested for their nickel content (which is the criterion) and have proved to be of celestial metal. It is unlikely that the smelting of iron was known long before 1350 B.C., because the knowledge of the art would have been of supreme importance, in trade and war, to any primitive people; it would have sufficed to give them instant dominance over their contemporaries.

We must meet Prof. Dart's conclusion, therefore, with justifiable scepticism. He says: "These facts reveal the extreme age (3000 to 4000 years) of the knowledge of smelting and the working of metals in Northern Rhodesia". This dictum is based upon the finding, by an Italian scientific expedition, of a foundry, slag, and ashes at a depth of six feet in a deposit containing implements characteristic of the Stone Age. The deposit lies within a limestone cave at Mumbwa, near the Kafue river, a tributary of the Zambezi. The find is said to prove that "the smelting is coeval with the later phases of the Palæolithic period in Northern Rhodesia", and shows that "the knowledge of metallurgy was introduced by a superior race into an Africa still in the throes of the Stone Age". This is true enough, but it does not prove an antiquity of 3000 or 4000 years, that is, so long ago as 2070 B.C. What it does prove, I submit, is that foreigners, versed in iron-making, established themselves for a time in the cave, possibly for self-defence, and during their sojourn they made iron weapons for use against the natives, who then were using the "quartz flakes and quartz implements of the Late Stone Age type"—in short, were the savages that Livingstone, Cameron, and Stanley found in that part of the world seventy years ago.

The invaders probably were slave-hunting Arabs, and the date of their incursion may be anything from A.D. 1200 to A.D. 1900, but no B.C. chronology is permissible. The Italian expedition has not finished its exploratory research; perhaps when all the information available is collected we shall be given a more convincing interpretation of the facts.

Apropos of early iron-making, I may mention that sundry writers have imputed the ancient Egyptians' knowledge of the art to a borrowing from their southern neighbours, the Ethiopians, this idea being lent some colour by the fact that the natives in central Africa, more particularly the Kenya and Congo regions, know how to make iron in a crude manner. Crudity of method, however, does not prove antiquity of origin. The denial to any such supposition is found in the description by Herodotus of the weapons used by the Ethiopian contingent in the army of Xerxes. Their armament consisted of "long bows, on which they placed short arrows made of cane, not tipped with iron, but with stone that was made sharp, and of the kind of which we engrave seals. Besides these they had javelins, tipped with antelope's horn that had been made sharp, like a lance. They had also knotted clubs." All of which indicates a complete ignorance of metallurgy. T. A. RICKARD.

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Oct. 6.

The Nature of the Vacuome and the Golgi Apparatus in Oogenesis.

I HAVE read with great interest the recent communications of Miss M. O'Brien and Prof. Gatenby (NATURE, June 14, 1930) and of Prof. Bhattacharya and Dr. Das (NATURE, Nov. 2, 1929) on the *Lumbricus* and the pigeon ovary respectively. For the first time these authors have demonstrated that in the egg cells also the vacuolar system (vacuome) and the classical Golgi apparatus are independent cell-components. A similar conclusion has already been arrived at in plant cells by Bowen (*Z. Zellf.*, 1928) and by Patten, Scott, and Gatenby (*Quar. Jour. Roy. Mic. Soc.*, 1928), in animal male germ cells, by Hirschler, Monné, Voinov, and Gatenby (for references see Gatenby, *Proc. Roy. Soc.*, 1929), and most recently in animal somatic cells also by Beams (*Anat. Rec.*, 1930), and by Gatenby and O'Brien.

Now both in the case of the earthworm and the pigeon ovary the use of neutral red has been found necessary to demonstrate the vacuolar system. Prof. Gatenby and his collaborator, therefore, have been naturally careful in stating that "it does not seem possible entirely to dismiss the idea that these globules might be segregation vacuoles and not pre-existing structures".

On the other hand, in the eggs of *Rana tigrina* (Nath, in press) and the teleostean fishes *Ophiocephalus punctatus* and *Rita rita* (Nath and M. D. Nangia, in press), not only the mitochondria and the Golgi elements but also the vacuoles can be seen *intra vitam* side by side separately *without the aid of neutral red or osmic acid*. This is due to the greater density and the larger size of the vacuoles of these three species. In *Ophiocephalus punctatus* the vacuoles begin condensing inside them protein material from a very early stage in oogenesis and actually form the albuminous yolk of the egg, as has been very rightly claimed for *Perca* and *Pygosteus* by Hibbard and Parat