retaining power, even of the wet material. In tropical climates there is particularly a great disadvantage in clothes which lessen evaporation. Heat-stroke is due to excessive heat stagnation.

In regard to indoor conditions, these should approximate as near as possible to the outdoor conditions of an ideal day.

Successful ventilation not only prevents heat stagnation of the body, but also keeps the temperature such that it stimulates the worker without producing uncomfortable cooling of the body.

In the British climate, of mist and cloud, radiant heat is always preferable to convected heat, hence the superiority of the open fire and the modern gas-stove. Radiant heat makes up for the absence of sunlight. Buildings should always, so far as possible, be warmed in such a manner as to keep the feet warm and the head cool. The judicious employment of fans to impart air movement will frequently make all the difference between good and bad ventilation. Dr. Hill's kata-thermometers prove of the greatest service in investigating the ventilation conditions of any building, and it is certain that they must be extensively employed in future to ensure satisfactory conditions, particularly in large buildings.

The question of the bodily heat regulation in the tropics is one of vital importance to the colonising white man. For years past there has been discussion as to whether it is possible for the white man to adapt himself efficiently to tropical climates, or whether this can be done only by pigmented races. Many authorities have inclined to the latter view.

The effect of the tropics is largely due to the action of the sun's visual rays, particularly those of the blue end, which, if sufficiently powerful and prolonged in action, have a lethal effect upon protoplasm. The ultra-violet rays are filtered out by the horny layer of the epidermis. The scales of the skin reflect diffusively many of the visual rays, particularly when the skin is wet with sweat. The function of pigment is to absorb the visual rays, thereby protecting the blood and living tissues from dangerous effects. The pigmented man can, therefore, have a thinner horny layer to his skin, and lose heat well through flushed blood-vessels, without risks of injurious effects from ground glare and sky shine. The view which attributes a higher heat-emissive power to the skin of the negro is erroneous. Despite the above advantages, however, pigment puts an extra tax on the heat-regulating mechanism of the body, since it has to get rid of the heat into which light rays are converted.

The great value of pigment is that it protects man from sunburn, and enables him to go naked and secure the full cooling power of the environment by losing heat by radiation, convection, and evaporation. The white man wears clothes to protect himself from sunburn, and the ill-effects of tropical climates are largely due to the wearing of unsuitable clothing, frequently from custom or from an idea of caste distinction. The white man also usually indulges in an unsuitable diet, which sets his heat production at too high a level. For this reason it is imperative that the white man in the tropics shall be suitably clothed and adjust his diet to the climate, resting during the hot hours, and taking exercise freely during the cool of the day.

The efficiency of the yellow races in hot climates shows that climatic adaptation to the tropics does not depend solely on pigmentation of the skin. As shown above, such adaptation seems to depend upon the correct correlation between the metabolism and the heat-losing mechanism of the body. Given proper sanitary measures against infectious disease, much can be done to promote the efficiency of the white race in hot climates by getting rid of the stagnant moist environment produced by clothes and houses. These in particular tell at present against the health of white women.

M. F.

The Discovery of Fossil Remains of Man in Java, Australia, and South Africa.

By PROF. A. KEITH, F.R.S.

PROF. EUGENE DUBOIS, the discoverer of Pithecanthropus, has recently published[1] an account of fossil remains of man found in a deposit in Java, which he regards as of Pleistocene age. In 1890, the year before he made his first find of the remains of Pithecanthropus at Trinil, Prof. Dubois was led to search for traces of ancient man in the district of Wadjak, which lies some sixty miles to the south-east of the site where his more famous discovery was made. His attention had been directed to the Wadjak district by the discovery there of a fossilised human skull in 1889. Further excavations of the terrace-like deposit in which the first skull had been found placed Prof. Dubois in possession of fragments of the jaws and cranium of a second individual, which were in the same state of mineralisation as the skull which first came to light.

Prof. Dubois has only now published a full account of these discoveries, made thirty years ago. He finds that the remains unearthed at Wadjak indicate that Java was at one time inhabited by a people very like the blacks of Australia, but in some respects even more primitive than they. The publication of an account of a fossil human skull found at Talgai, Queensland, by Dr. Stewart A. Smith[2] in 1918 has apparently induced Prof. Dubois to reinvestigate the fossil remains from Wadjak, and to compare them with the ancient Talgai skull. Thus for the first time it is possible for anthropologists to compare

[1] "De Proto-Australische fossiele Mensch van Wadjak (Java)." *Kon. Akad. van Wetensch. te Amsterdam Afdeeling*, May 29, 1920.

[2] Phil. Trans., 1918, ser. B, vol. ccviii., p. 351

the ancient inhabitants of Java and Queensland. The discovery in 1913 of fossilised human remains at Boskop, in the Potchefstroom district of the Transvaal, throws a welcome light on the ancient inhabitants of South Africa, and gives the means of comparing the early inhabitants of remote continents. An account of the Boskop find was contributed to NATURE for August 5, 1915, vol. xcv., p. 615, by Mr. F. W. FitzSimons, of Port Elizabeth Museum, and a detailed description of the remains has since been published by Mr. S. H. Haughton.[3] In none of these discoveries, in Java, in Queensland, or in South Africa, has it been possible to give a definite geological age to the deposits in which the human remains occurred, yet in each case a Pleistocene date has been assigned to the remains by their describers—an inference which is justified, not only by their condition and surroundings, but also by the primitive structural features which are stamped on them.

The more complete fossil skull described by Prof. Dubois is that of a woman showing features which characterise Australoid races, save that the dimensions of the skull are excessive. The length of this ancient woman's skull is 200 mm. and its width 145 mm., measurements which are rarely met with even in the most robust Australian male aborigines. Prof. Dubois, allowing for the great thickness of the cranial wall—10 mm. on the vault—estimates that its cranial capacity or brain space was 1550 c.c.—more than 200 c.c. above that of the average modern Englishwoman. The jaws of the second individual found are much larger and more robustly framed than those of the woman, and are inferred by Prof. Dubois to represent the opposite sex. The upper jaw and palate of this ancient man of Java are such as have never been seen before in either ancient or modern man. In anthropoid apes the molar teeth are set in two approximately parallel rows on each side of the palate; this arrangement is more exactly preserved in the extinct natives of Tasmania, and to a less degree in the native tribes of Australia, than amongst any other existing race of mankind. But in the Java or Wadjak skulls, although Australoid in all their cranial and facial features, the teeth are set on the palate in a horseshoe form, much as is the case in the Pleistocene European—*Homo neanderthalensis*. The teeth, however, show none of the dental characteristics of that race. The width of the palatal area of the Wadjak fossil man, measured between the outer borders of the second molar teeth, is 81 mm., 7 mm. more than has yet been observed in any human palate. The length of the palate—measured from the crowns of the incisors to a line joining the hinder borders of the last molar teeth—must have been well above 60 mm.—a measurement occasionally exceeded in the palates of modern Australian natives. The palatal area, enclosed within the outer border of the dental arch, is enormous, being, according to Prof. Dubois' estimate, 41·4 sq. cm., to which some 4 sq. cm. must be added on account of the missing incisor crowns. The corresponding area of the average modern Englishman is 26 sq. cm.; the largest measurement in living native races is 36·7 sq. cm. These figures give some indication of the remarkable jaw and face development of the fossil Wadjak race.

The Talgai skull from Queensland, described by Dr. S. A. Smith, of Sydney University, is that of a lad of about fifteen or sixteen years of age. Its cranial walls had been severely crushed by earth-pressure, but fortunately the palate and face are in good condition—a most fortunate circumstance, for it becomes more and more evident that we must trust to facial rather than to cranial features for the recognition and discrimination of human races. So far as the cranial features and dimensions of the Talgai lad are preserved, they show Australoid characteristics—the cranial capacity being certainly above that of Australian aboriginal youths of the present day. Here, again, the outstanding character of the fossil type is to be found in the palate, which has been very fully investigated and described by Dr. S. A. Smith. In the form of its dental arcade the Talgai skull possesses the most anthropoid palate yet discovered. Very probably, were the palate of Piltdown man to be found, it would show these anthropoid features to an even greater degree. The two canine teeth in the Talgai boy are set very widely apart, almost as widely as the molar teeth. The width of the palatal area is 66·5 mm.; allowing for the unerupted wisdom teeth, its length amounts to about 70 mm.; the total area, although less than on the Javanese fossil Australoid skull, is still very large, amounting to about 40 sq. cm.

Thus we have evidence which seems to justify us in supposing that at a certain period of the Pleistocene age men fashioned in a primitive Australoid mould, with large brains and massive palates, lived in Java and Australia; but so far as the palate is concerned the fossil stock of Java had differentiated in one direction, the Australian in another. It is amongst the extinct race, which inhabited Tasmania down to modern times, that we find the nearest approach to the anthropoidal palate and the massive teeth of the Talgai boy. On a consideration of all his features we must place the Talgai boy in the ancestral stock of the Tasmanian type of Australoids. Dr. S. A. Smith cites the discovery of the fossil bones of the dingo in Australian deposits of Pleistocene date as evidence of the early arrival of man in the continent of Australia, for it is difficult to believe that the native dog arrived save in the company of man. The discoveries made at Talgai, in Queensland, and at Wadjak, in Java, lend strong support to this early arrival of man in Australia. Whether the Talgai lad represents the first invaders, and whether these early comers were the primitive ancestors of the aborigines of Tasmania, are doubts which must be settled by future discoveries.

[3] Trans. Roy. Soc. South Africa, 1917, vol. vi., p. 1.

In strange contrast to these ancient inhabitants of Java and Queensland is the ancient type of South Africa represented by the Boskop man. The characters of his skull are so peculiar that we must regard him as a separate and hitherto unknown type. As to his facial characters we know little; his eyebrow ridges and forehead show certain features which give grounds for the belief that the face was flattened—much as in living representatives of the Hottentot and Bushman stocks. From the fragmentary lower jaw one infers that the teeth and palate were of very moderate dimensions—not much larger, if any, than in modern Europeans. The dimensions of the cranial cavity, on the other hand, are enormous: the length of the cranium is 205 mm.; its width 154 mm.; and its capacity or brain space is estimated by Mr. Haughton to be 1832 c.c.—about 350 c.c. above the average for Englishmen. The vault of the skull is thick and flat, two great parietal bosses of bone rising up on each side of its median suture and marking the sites of the parietal eminences. There are also peculiar features in the region of the mastoid process behind the ear and in the zygomatic-temporal region in front of it. The only fossil skull which shows any marked degree of resemblance to the Boskop specimen is the Olmo skull found in a Pleistocene deposit in the north of Italy in 1863. It, too, is a very wide and long skull, with flat roof and projecting upper forehead, but showing none of the peculiar features of the Boskop skull. Mr. Haughton has rightly recognised that certain traits which are found in the Hottentot and Bushman skulls, as well as in the Boskop cranium, can best be explained by supposing the Boskop man to stand in the Pleistocene ancestry of those puzzling Mongolian negroids of South Africa—the Hottentots and Bushmen. Further, on the strength of the evidence referred to in the foregoing, we find, at a remote period in South Africa and in Australia, primitive representatives of the native races now occupying these countries; differentiation from the primitive to the modern type seems to have taken place *in situ* in each case.

Obituary.

THE death occurred on Thursday, December 23, of MR. FRANK PULLINGER, C.B., Chief Inspector of the Technological Branch of the Board of Education. Mr. Pullinger, who was born in 1866, was educated at Manchester Grammar School, Owens College, Manchester, and Corpus Christi College, Oxford. He took a First Class in the Final Honours School of Natural Science in 1887, and in 1889 was elected Burdett Coutts scholar of the University. After spending a year in research work at Oxford and another year as a University extension lecturer, he was in 1891 appointed Secretary for Education to the Devonshire County Council. This post he relinquished in 1894 in order to take up an appointment as an Inspector of Schools under the Science and Art Department. In 1900 Mr. Pullinger was appointed Divisional Inspector and in 1908 Chief Inspector of the Technological Branch of the Board of Education, into which the Science and Art Department had been merged. He was a man of great force of character and possessed a very intimate knowledge of the needs of technical education. The years during which he was Chief Inspector witnessed a rapid growth in the responsibilities of the Board towards technical education, and Mr. Pullinger's wide experience and close association with technical problems were in consequence of very great value. In particular it may be said that he organised an inspectorate containing in its ranks men of expert knowledge in engineering, building, chemical, and other industries, and transformed the whole process of inspection. His death at a comparatively early age is greatly regretted by all who have the future of technical education at heart.

THE death is announced on Christmas Day of the REV. HENRY HOYTE WINWOOD, of Bath, at the age of ninety years. Mr. Winwood was for half a century one of the most active amateur geologists in the West of England, and the stimulating friend of many who have made important advances in geological science. In early life he was associated with Prof. (now Sir) W. Boyd Dawkins and the late Mr. W. A. Sanford in several explorations of bone-caves and prehistoric burial places. In 1865 he announced the discovery of flint implements in definite association with the remains of extinct animals in the cave named Hoyle's Mouth, near Tenby. In his own district he diligently observed all temporary excavations, and made notes which were published in the Proceedings of the Bath Natural History Club. When the British Association visited Bath in 1888 he wrote the section on geology for the local handbook. He also took much interest in the Bath Royal Institution, and collected the fund by which it secured the unique museum of local fossils of the late Charles Moore. He delighted in making this museum accessible for the promotion of research. Mr. Winwood was elected a fellow of the Geological Society in 1864, served for many years on the council, and was a vice-president in 1898–1900 and 1915–17.

THE death of MR. J. G. V. MAIR-RUMLEY on December 20, in his seventy-eighth year, is announced. Mr. Mair-Rumley was a member of the Institutions of Civil Engineers and Mechanical Engineers, and gave much assistance to the research committees inaugurated by the latter institution. His papers contributed to the Institution of Civil Engineers were awarded the Watt medal and a Telford premium in 1881, and a Telford premium in 1885.