

very poorly represented in the Lena. As M. Bunge gives great attention to the collecting of skulls of animals, his collection promises to be of great value, as also his collection of human skulls taken from the coffins that dot the tundra—the Yakuts merely putting them on the surface between a few rough planks. It is worthy of notice that, whilst having many opportunities for visiting the sick Yakuts in the neighbourhood, M. Bunge has not yet noticed a single case of scurvy; it is quite unknown among them.

WE have received a separate copy from the forthcoming number of the *Izvestia* of the Russian Geographical Society of a notice of the remarkable Russian expeditions to the Pamir, carried on during last summer. It is sufficient to cast a glance at the map that accompanies this note to ascertain that "the Roof of the World" has now been quite deprived of the veil of mystery that covered it for centuries past. Many years since Russian travellers penetrated into it, and studied detached portions as they followed the course of the rivers which led to these gigantic plateaux, inclosed between still higher mountains. Pursuing his researches for several consecutive years, Dr. Regel and his companions have explored the valleys of the Panj and of its numerous tributaries, penetrating as far south as Sist (37° N. lat.) and as far east as the sources of Shakh-dere, 72° 50' E. long. An immense bend to the west of the Panj River beneath Kala-vamar, due to the presence of a high chain of mountains running north-east, and a wide lake, Shiva, 11,000 feet high, situated to the west of this bend, discovered by Dr. Regel, considerably modify our former maps of the western part of the Pamir region. But the expedition of last summer, which consisted of MM. Putiata, of the general staff, Ivanoff, geologist, and Bendersky, topographer, throws quite a new light on the still less known eastern Pamir. The expedition has literally covered with a network of surveys the whole of this region from 39° 30' N. lat. to the sources of the Vakhan-daria, in 37° 10', and from 72° 10' to 75° 20' E. long., penetrating thus twice to the foot of the Mustag-aga, or Tagarma Peak. The great Pamir chain, between the Shakh-dere and the Upper Panj has been crossed at four places, 100 miles distant, and the Russian surveys have been brought into connection with those of the pundit M. S. The expedition seems to have established that the pundit M. S. was misled, and that the Ak-ku is really the upper part of the Murghab. The other results of this expedition are also very important: not only a map on the scale of five vers's to an inch of the whole of this wide region has been drawn, but also the heights of a very great number of points have been determined by barometrical and trigonometrical measurements; large geological and botanical collections have been brought in, as well as many drawings, and a dictionary of the Shughnan language. Detailed reports will follow, the foregoing information being due to a preliminary letter of M. Ivanoff.

A TELEGRAM from Nerchinsk, in Siberia, states that M. Joseph Martin, the French traveller, passed through that place recently on his way to Irkutsk. M. Martin has (says a Reuter's telegram) explored the country from the Lena to the Amur, and has crossed the intervening Starovi Mountain range. He has collected a large amount of geographical and geological information concerning the region which he has traversed.

MR. SCHUVER, the Dutch African explorer, has been murdered at Bahr Gazal, in South Kordofan.

ACCORDING to the latest number of the *Annalen der Hydrographie und maritimen Meteorologie* the greatest depth of the Atlantic is 8341 metres; this was found in 19° 39' 10" N. lat., and 60° 26' 5" W. long. The next greatest depression of the sea bottom is in 19° 23' 30" N. lat., and 66° 11' 45" W. long., where 7723 metres were found.

### THE AIMS AND PROSPECTS OF THE STUDY OF ANTHROPOLOGY<sup>1</sup>

THOSE who are present at this meeting need scarcely be reminded of the importance of the subject which is our common bond of union, that which is defined in the prospectus of the Institute as "the promotion of the science of mankind

by the accumulation of observations bearing on man's past history and present state in all parts of the globe."

But those present are a very small fraction indeed of the persons in this country to whom this great subject is, or should be in some one or other of its various divisions, a matter of deep interest, and as it is possible that the words which it is my privilege and duty as your president to address to you on this occasion may be read by some who are not yet so much conversant with the aims of anthropology and the means for its cultivation which this Institute affords as those who have taken the trouble to come here this evening, I hope that you will pardon me if I bring before you some general considerations, perhaps familiar to all of you, regarding the scope and value of the science the advancement of which we have at heart.

One of the great difficulties with regard to making anthropology a special subject of study, and devoting a special organisation to its promotion, is the multifarious nature of the branches of knowledge comprehended under the title. This very ambition, which endeavours to include such an extensive range of knowledge, ramifying in all directions, illustrating and receiving light from so many other sciences, appears often to overleap itself and give a looseness and indefiniteness to the aims of the individual or the institution proposing to cultivate it.

The old term ethnology has a far more limited and definite meaning. It is the study of the different peoples or races who compose the varied population of the world, including their physical characters, their intellectual and moral development, their languages, social customs, opinions, and beliefs, their origin, history, migrations, and present geographical distribution, and their relations to each other. These subjects may be treated of under two aspects—first, by a consideration of the general laws by which the modifications in all these characters are determined and regulated; this is called general ethnology; secondly, by the study and description of the races themselves, as distinguished from each other by the special manifestations of these characters in them. To this the term special ethnology, or, more often, ethnography, is applied.

Ethnology thus treats of the resemblances and differences of the modifications of the human species in their relations to each other, but anthropology, as now understood, has a far wider scope. It treats of mankind as a whole. It investigates his origin and his relations to the rest of the universe. It invokes the aid of the sciences of zoology, comparative anatomy, and physiology; and the wider the range of knowledge met with in other regions of natural structure, and the more abundant the terms of comparison known, the less risk there will be of error in attempting to estimate the distinctions and resemblances between man and his nearest allies, and fixing his place in the zoological scale. Here we are drawn into contact with an immense domain of knowledge, including a study of all the laws which modify the conditions under which organic bodies are manifested, which at first sight seem to have little bearing upon the particular study of man.

Furthermore, it is not only into man's bodily structure and its relations to that of the lower animals that we have to deal; the moral and intellectual side of his nature finds its rudiments in them also, and the difficult study of comparative psychology, now attracting much attention, is an important factor in any complete system of anthropology.

In endeavouring to investigate the origin of mankind as a whole, geology must lend its assistance to determine the comparative ages of the strata in which the evidences of his existence are found; but researches into his early history soon trench upon totally different branches of knowledge. In tracing the progress of the race from its most primitive condition, the characteristics of its physical structure and relations with the lower animals are soon left behind, and it is upon evidence of a kind peculiar to the human species, and by which man is so pre-eminently distinguished from all other living beings, that our conclusions mainly rest. The study of the works of our earliest known forefathers, "prehistoric archæology," as it is commonly called, although one of the most recently developed branches of knowledge, is now almost a science by itself, and one which is receiving a great amount of attention in all parts of the civilised world. It investigates the origin of all human culture, endeavours to trace to their common beginning the sources of all our arts, customs, and history. The difficulty is what to include and where to stop; as, though the term "prehistoric" may roughly indicate an artificial line between the province of the anthropologist and that which more legitimately belongs to the archæolo-

<sup>1</sup> Address delivered at the anniversary meeting of the Anthropological Institute of Great Britain and Ireland, January 22, 1884, by Prof. Flower, LL.D., F.R.S., P.Z.S., &c., President.

gist, the antiquary, and the historian, that the studies of the one pass insensibly into those of the other is an evident and necessary proposition. Knowledge of the origin and development of particular existing customs throws immense light upon their real nature and importance, and conversely, it is often only from a profound acquaintance with the present or comparatively modern manifestations of culture that we are able to interpret the slight indications afforded us by the scanty remains of primitive civilisation.

Even the more limited subject of ethnology must be approached from many sides, and requires for its cultivation knowledge derived from sciences so diverse, and requiring such different mental attributes and systems of training, as scarcely ever to be found combined in one individual. This will become perfectly evident when we consider the various factors or elements which constitute the differential characters of the groups or races into which mankind is divided. The most important of these are—

1. Structural or anatomical characters, derived from diversities of stature, proportions of different parts of the body, complexion, features, colour and character of the hair, form of the skull and other bones, and the hitherto little-studied anatomy of the nervous, muscular, vascular, and other systems. The modifications in these structures in the different varieties of man are so slight and subtle, and so variously combined, that their due appreciation, and the discrimination of what in them is essential or important, and what incidental or merely superficial, requires a long and careful training, superadded to a preliminary knowledge of the general anatomy of man and the higher animals. The study of physical or zoological ethnology, though it lies at the basis of that of race, is thus necessarily limited to a comparatively few original investigators.

2. The mental and moral characters by which different races are distinguished are still more difficult to fathom and to describe and define, and although the subject of much vague statement, as there are few people who do not consider themselves competent to give an opinion about them, they have hitherto been rarely approached by any strictly scientific method of inquiry.

3. Language.—The same difficulties are met with in the study of language as in that of physical peculiarities; in the discrimination between the fundamental and essential, and the mere accidental and superficial resemblances, and in proportion as these difficulties are successfully overcome will be the results of the study become valuable instead of misleading. Though the science of language is an essential part of ethnology, and one which generally absorbs almost the entire energies of any one who cultivates it, its place in discriminating racial affinities is unquestionably below that of physical characters. Used, however, with due caution, it is a powerful aid to our investigations, and in the difficulties with which the subject is surrounded, one which we can by no means afford to do without.

4. The same may be said of social customs, including habitations, dress, arms, food, as well as ceremonies, beliefs, and laws, in themselves fascinating subjects of study, placed here in the fourth rank, not as possessing any want of interest, but as contributing comparatively little to our knowledge of the natural classification and affinities of the racial divisions of man. When we see identical and most strange customs, such as particular modes of mutilation of the body, showing themselves among races the most diverse in character and remote geographically, we cannot help coming to the conclusion that these customs have either been communicated in some hitherto unexplained manner, or are the outcome of some common element of humanity, in either of which cases they tell nothing of the special relations or affinities of the races which practise them.

This subject of ethnography, or the discrimination and description of race characteristics, is perhaps the most practically important of the various branches of anthropology. Its importance to those who have to rule, and there are few of us now who are not called upon to bear our share of the responsibility of government, can scarcely be over-estimated in an empire like this, the population of which is composed of examples of almost every diversity under which the human body and mind can manifest itself. The physical characteristics of race, so strongly marked in many cases, are probably always associated with equally or more diverse characteristics of temper and intellect. In fact, even when the physical divergences are weakly shown, as in the case of the different races which contribute to make up the home portion of the empire, the mental and moral characteristics are still most strongly marked. As it behoves the wise physician not only to

study the particular kind of disease under which his patient is suffering, and then to administer the approved remedies for such disease, but also to take into careful account the peculiar idiosyncrasy and inherited tendencies of the individual, which so greatly modify both the course of the disease and the action of remedies, so it is absolutely necessary for the statesman who would govern successfully, not to look upon human nature in the abstract and endeavour to apply universal rules, but to consider the special moral, intellectual, and social capabilities, wants, and aspirations of each particular race with which he has to deal. A form of government under which one race would live happily and prosperously would to another be the cause of unendurable misery. No greater mistake could be made, for instance, than to apply to the case of the Egyptian fellah the remedies which may be desirable to remove the difficulties and disadvantages under which the Birmingham artisan may labour in his struggle through life. It is not only that their education, training, and circumstances are dissimilar, but that their very mental constitution is totally distinct. And when we have to do with people still more widely removed from ourselves, African Negroes, American Indians, Australian or Pacific Islanders, it seems almost impossible to find any common ground of union or *modus vivendi*; the mere contact of the races generally ends in the extermination of one of them. If such disastrous consequences cannot be altogether averted, we have it still in our power to do much to mitigate their evils.

All these questions, then, should be carefully studied by those who have any share in the government of people of races alien to themselves. A knowledge of their special characters and relations to one another has a more practical object than the mere gratification of scientific curiosity; it is a knowledge upon which the happiness and prosperity, or the reverse, of millions of our fellow-creatures may depend.

It is gratifying to find, then, that there are in our own country—for on this occasion I will not speak of what is being done elsewhere—many signs that the prospects of a thorough and scientific cultivation of anthropology in its several branches are brightening.

I may first mention the publication of the final Report of the Anthropometric Committee of the British Association for the Advancement of Science, of which formerly the late Dr. W. Farr, and recently our vice-president, Mr. Francis Galton, have been chairmen, and in which Mr. Charles Roberts, Dr. Beddoe, Sir Rawson Rawson, and some other of our members have taken so active a part. This Report, and those which have from time to time been issued by the Committee during the progress of the work, contain a large mass of valuable statistical information relating to the physical characters, including stature, weight, chest girth, colour of eyes and hair, strength of arm, &c., of the inhabitants of the British Isles, illustrated by maps and diagrams. Excellent as has been the work of the Committee, there is still much to be done in the same direction, and larger numbers of observations even than those already obtained are in many cases necessary to verify or correct the inferences drawn from them. This is thoroughly acknowledged in the Report, which states in one of the concluding paragraphs that "the Committee believes that it has laid a substantial foundation for a further and more exhaustive study of the physical condition of a people by anthropometric methods, and that its action will prove that it has been useful as an example to other scientific societies and to individuals in stimulating them, as well as directing them in the methods of making statistical inquiries relative to social questions."

It is satisfactory to learn that many portions of the work thus inaugurated will be carried on by bodies specially interested in particular departments, as the Collective Investigation Committee of the British Medical Association, and the Committee of the British Association for collecting photographs and defining the characteristics of the principal races of the United Kingdom, a subject in which Mr. Park Harrison is taking so deep an interest.

It should be mentioned that the original returns upon which the reports of the Committee are based, including much information which has not yet been analysed and tabulated, on account of the time and labour such a process would involve, as well as the instruments of investigation purchased with funds supplied by the British Association, have been, by the consent of the Council of the Association, placed under the charge of the officers of this Institute.

It is very satisfactory, in the next place, to be able to record that our great centres of intellectual culture are gradually

waking up from that state of apathy with which they have hitherto regarded the subject of anthropology.

In Oxford the impulse given by the genius and energy of Rolleston has begun to bear fruit. The University has taken charge of the grand collection of ethnological objects most liberally offered to it by our former president, General Pitt-Rivers, and has undertaken not only to provide a suitable building for its reception but also to maintain it in a manner worthy of the scientific discernment and munificence displayed by the donor in collecting and arranging it. Furthermore Oxford has shown her wisdom in affiliating to herself the most learned of English anthropologists in the widest sense of the word, one of the few men in this country who has made the subject the principal occupation of his life. I need scarcely say that I refer to another of our former presidents, Mr. E. B. Tylor. By conferring a Readership in Anthropology upon him Oxford has instituted the first systematic teaching of the subject yet given in any educational establishment in this country, and it is a great credit to the oldest University that it should thus lead the way in one of the most modern of sciences. It is, however, only a beginning; the whole of the great subject is confined to the teaching of one individual with modest stipend, and not admitted to the dignity of the professoriate. In the *École des Hautes Études* at Paris anthropology is taught theoretically and practically in six different branches, each under the direction of a professor who has specially devoted himself to it, aided, in some cases, by several assistants.

In Cambridge also there are many hopeful signs. The recently-appointed Professor of Anatomy, Dr. Macalister, is known to have paid much attention to anatomical anthropology, and has already intimated that he proposes to give instruction in it during the summer term. An Ethnological and Archæological Museum is also in progress of formation, which, if not destined to rival that of Oxford, already contains many objects of great value, and a guarantee of its good preservation and arrangement may be looked for in the recent appointment of Baron Anatole von Hügel as its first curator.

Perhaps in no place in the world could so varied and complete an anthropological collection be expected as in the national museum of this country, which should be the great repository of the scientific gleanings of the numerous naval, military, exploring, and mercantile expeditions sent out by the Government or by private enterprise for more than a century past, and penetrating into almost every region of the globe. Our insular position, maritime supremacy, numerous dependencies, and ramifying commerce, have given us unusually favourable opportunities for the formation of such collections, opportunities which unfortunately in past times have not been used so fully as might be desired. There is, however, a great change coming over those who have charge of our national collections in regard to this subject. Thanks to the foresight and munificence of the late Mr. Henry Christy, and the well-directed energies of Mr. Franks and his colleagues, the collection illustrating the customs, clothing, arts, and arms of the various existing and extinct races of men, in the British Museum, is rapidly assuming an importance which will be a surprise to those who see it for the first time arranged in the large galleries formerly devoted to mammals and birds. Even the grand proportion of space allotted to this collection in the re-arrangement of the Museum is, I am told, scarcely sufficient for its present needs, to say nothing of the accessions which it will doubtless receive now that its importance and good order are manifest.

A national collection of illustrations of the physical characters of the races of men, fully illustrated by skeletons, by anatomical specimens preserved in spirit, by casts, models, drawings, and photographs such as that which exists in the *Muséum d'Histoire Naturelle* at Paris, is still a desideratum in this country. The British Museum till lately ignored the subject altogether, and in the beginning of the century actually expelled such specimens of the kind as had accidentally found their way within its walls. Recently, however, skulls and skeletons of man have been admitted, and since the removal of the zoological collections to the new building at South Kensington their importance as an integral part of the series has been recognised, and their exhibition in the osteological gallery will doubtless stimulate the growth of what we may trust will be ultimately a collection worthy of the nation, although unfortunately, from causes too well known, the difficulties of procuring pure examples of many races are gradually increasing, and in some cases have become well-nigh insuperable. The

museum contains at present 407 specimens illustrating human osteology, of which 10 are skeletons more or less complete.

In the meantime the College of Surgeons of England has done much to supply the deficiency. During the last twenty years it has let few opportunities pass of attracting to itself, and therefore saving from the destruction or lapse into the neglected, valueless condition into which small private collections almost invariably ultimately fall, a large number of specimens, now, it is to be hoped, placed permanently within the reach of scientific observation. The growth of this collection may be illustrated by the fact that, whereas at the time of the publication of the Catalogue in 1853 it consisted of 18 skeletons and 242 crania, it now contains 89 more or less complete skeletons and 1380 crania, nearly all of which have been added during the last twenty years. This is, moreover, irrespective of the great collection of Dr. Barnard Davis, purchased in 1880 by the College, which was thus the means of preserving intact, for the future advantage and instruction of British anthropologists, an invaluable series of specimens otherwise probably destined to have been dispersed or lost to the country for ever. This collection consists of 24 skeletons and 1539 crania, making, with the remainder of the College collection, a total of 3032 specimens illustrating the osteological modifications of the human species. These are all in excellent order, clean, accessible, and catalogued in a manner convenient for reference, although somewhat too crowded in their present locality to be readily available for observation.

Large as is this collection, and rich in rare and interesting types, it is far from exhaustive; many great groups are almost or entirely unrepresented even by crania, and the series of skeletons is (with the exception of one race only, the Andamanese) quite insufficient to give any correct idea of the average proportions of different parts of the framework. In fact, such a collection as would be required for this purpose must be quite beyond the resources of, as well as out of place in, any but a national museum.

The collections illustrating anatomical anthropology in the University museums of Oxford, Cambridge, Edinburgh, and Dublin have all greatly increased of late, but for the reasons just given they can never be expected to attain the dimensions required for the study of the subject in its profoundest details. The small, but very choice collections formed by the officers of the medical department of the army, and kept in the museum of the Royal Victoria Hospital at Netley, and that of the navy at Haslar Hospital, are, I believe, in a stationary condition, but in good preservation. Our own collection, which also contains some valuable specimens (notably the complete skeleton of one of the extinct Tasmanian aborigines, presented by the late Mr. Morton Allport), and which during the past year has been catalogued for the first time by Mr. Bloxam, has not been added to, owing to a feeling which the Council has long entertained, and which induced them to part with the ethnological collection, that a museum, entailing as it does, if worthily kept up, a very considerable annual expense, is not within the means of the Institute, at all events not until the more pressing claims of the library and the publications are fully satisfied.

This leads me to speak, in conclusion, of the work accomplished during the past year by the Institute, and of its present position and future prospects.

I must first refer to that portion of the retrospect of the year which always casts a certain sadness over these occasions—the losses we have sustained by death. Happily these have not been numerous, and do not include, as has been the case in many former years, any from whom great work in our own subject might still have been expected. Though we were all proud to number William Spottiswoode, the President of the Royal Society, among our members, and though we all honoured him for his accomplishments in other branches of science, and loved him for his work as a man who rose high above his fellows in his chivalrous sense of honour and simple dignity of demeanour, we could not claim him as a worker at anthropology.

Lord Talbot de Malahide's antiquarian pursuits frequently verged upon our own subjects in their proper sense, and he was often present at our meetings, and a very recent contributor to our journal. He had, however, reached the ripe old age of eighty-two.

From the list of our honorary members we have lost a still more venerable name, that of Sven Nilsson, Professor in the Academy of Lund. He was born on March 8, 1787, and died on November 30 of last year, and was therefore

well on in his ninety-seventh year. His long-continued and laborious researches in the zoology, palæontology, anthropology, and antiquities of his native land gave him a high place among men of science. Among a host of minor contributions he was the author of a standard work on the Scandinavian fauna; but that by which he was best known to us is the book of which the English translation, edited by Sir John Lubbock, bears the title of "The Primitive Inhabitants of Scandinavia; an Essay on Comparative Ethnography, and a Contribution to the History of the Development of Mankind."

The number of our ordinary members has been fairly kept up, the additions by election having slightly exceeded the losses by death and resignation; but a larger increase in the future will be necessary in order to carry on the operations of the Institute in a successful manner, especially under the new conditions to which I shall have to advert presently. Even by the most careful management our treasurer has not succeeded in bringing the expenditure of the year quite within our ordinary income.

The journal, I am glad to report, has been brought out with exemplary punctuality, under the able and energetic supervision of our director, Mr. Rudler. To this part of our operations I think we may look with unmixed satisfaction, the number, character, and variety of the communications contained in it being quite equal to those of former years.

With regard to our future, the next year will probably be one of the most momentous in our annals, as we have determined upon a great step, no less than a change of domicile. It was ascertained in the course of last summer that we could only remain in our present quarters at an increased rent upon that which we had hitherto paid, and we therefore considered whether it would be possible to obtain as good or better accommodation elsewhere. It happened fortunately that the Zoological Society was about to move into new freehold premises at No. 3, Hanover Square, and would have spare rooms available for the occupation of other societies. A committee of the Council was appointed to examine and report upon the desirability of moving, and negotiations were entered into with the Council of the Zoological Society which have ended in our becoming their tenants for the future. We shall have for the purposes of our library, office, and Council meetings, two convenient rooms on the second floor immediately above the library of the Zoological Society, and for the purpose of storing our stock of publications a small room on the basement. We shall also have the use of a far more handsome and commodious meeting room than that which we occupy at the present moment, and in a situation which is in many respects more advantageous. Let us trust that this change may be the inauguration of an era of prosperity to the Institute, and of increased scientific activity among its members.

#### THE FORMATION OF SMALL CLEAR SPACES IN DUSTY AIR<sup>1</sup>

[In the introduction a few remarks are made on the growing interest in everything connected with dust, whether it be the organic germs floating in the air, or the inorganic particles that pollute our atmosphere. Prof. Tyndall's observations on the dark plane seen over a hot wire<sup>2</sup> are referred to, Lord Rayleigh's recent discovery of the dark plane formed under a cold body<sup>3</sup> is described, and attention called to Dr. Lodge's experiments described in a letter to NATURE, vol. xxviii. p. 297.

The experiments described in this paper were made in a small dust-box, blackened inside, glazed in front, and provided with a window at one side. For illumination two jets of gas inclosed in a dark lantern were used. The light entered the dust-box by the side window and could be condensed on any part of the inside of the box, by means of two lenses fixed in a short tube, and loosely attached to the front of the lantern. Magnifying glasses of different powers were used for observation. The dusts experimented on were made, some of hydrochloric acid and ammonia, some by burning sulphur and adding ammonia, some by burning paper, magnesium, or sodium. Calcined magnesia and lime were also used, as well as ground charcoal. These three last substances were stirred up by means of a jet of air.

<sup>1</sup> Abstract of a paper read to the Royal Society of Edinburgh, January 21, 1884, by Mr. John Aitken.

<sup>2</sup> "Essays on the Floating-Matter in the Air," p. 5. (Longmans, Green, and Co., 1881.)

<sup>3</sup> NATURE, vol. xxviii. p. 139.

For testing the effects of slight difference of temperature, tubes in some form or other were generally used. These tubes were closed at the front, projected through the back of the dust-box, and were brought close to the glass front for observation under strong magnifying power. The tubes were heated or cooled by circulating water through them, in a small tube passing through their interior.

Suppose the experiments to be begun by introducing a round tube into its place in the dust-box and then filling the box with any dust, everything being then left for some time so that all the apparatus may acquire the same temperature. If the light be now allowed to fall on the box, and be quickly brought to a focus on the tube, it will be found that the dust is in close contact with it on the top and sides, but *underneath* there will be seen a clear space. Close examination will show the particles to be falling on the upper surface of the tube, and coming into contact with it, while underneath a clear space is formed by the particles falling out of it. If the tube is now slightly cooled, a downward current is formed, and the currents of dustless air from below the tube meet under it, and form a dark plane in the centre of the descending current. It is shown that gravitation can, under favourable conditions, produce this separation of the dust quickly enough to keep up a constant supply of dustless air. No increase of effect is produced by a lower temperature. A temperature of  $-10^{\circ}$  C. makes the dark plane thinner, because it increases the rate of the descending current and carries away the purified air more quickly.

A form of apparatus was arranged to get rid of this separating effect of gravitation. It consisted of an extremely thin and flat piece of metal. This test-surface was placed *vertically* in the dust-box. The air in passing over this piece of apparatus was not caused to take up a horizontal movement at any part of its passage. The result was that even with a temperature of  $-10^{\circ}$  C. the dust kept close to its surface, and no dark plane was formed in the descending current. The dark plane in the cold descending current seems, therefore, not to be an effect of temperature, but is the result of the action of gravitation on the particles under the body. A dark plane was, however, observed when working with this flat surface when cooled, but it was not formed in dusty, but in foggy air, and was found to be due to the evaporation of the fog particles when they approached the cold surface.

If a very little heat, instead of cold, is applied to the round tube in the previous experiment, then the dark space under the tube rises and encircles the tube and the two currents of clear air unite over the tube and form the dark plane in the upward current. But in addition to this heat has been found to exert a repelling effect on the dust. This was proved by putting the thin vertical test-surface in the dust-box and heating it, when it was found that the dust was repelled from its surface, and a dark plane formed in the ascending current, neither of which effects was obtained with cold. The dust begins to be repelled with the slightest rise of temperature, and the dark space in front of the test-surface becomes thicker as the temperature rises. An experiment is then described in which air flowing up between two parallel glass plates is caused to pass from side to side of the channel by the repelling action of heat at different points.

For testing the effects of higher temperatures a platinum wire heated by means of a battery was used. The platinum wire was bent into a U-shape, the two legs being brought close together. This wire was fixed in the dust-box with the bend to the front, and the legs in the same horizontal plane, the two copper wires to which it was attached being carried backwards and out of the box. By this arrangement a clear view was obtained all round the wire, and other advantages secured. Experimenting with this apparatus it was found that every kind of dust had a different sized dark plane. With magnesia and other indestructible dusts it was very thin, with the sulphate dust it was much thicker, and with the sal-ammoniac dust thicker still. So thick was it with the two latter kinds of dust that the dark planes over the two legs expanded and formed one plane. As the particles could be seen streaming into the dark space under the wires, it was obvious that these large dark planes were not caused by repulsion, but by the evaporation or by the disintegration of the dust particles. When making the experiment in a mixture of different kinds of dusts, the hot wire was surrounded by a series of zones of different brightness, and having sharp outlines. The size of the different zones was determined by the temperature necessary to evaporate the different kinds of dust present, and