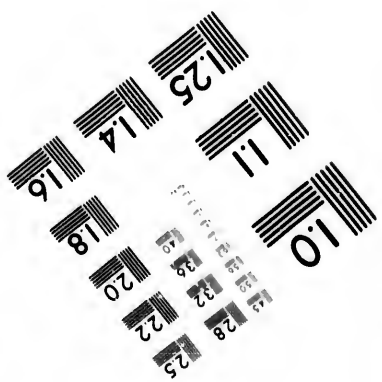
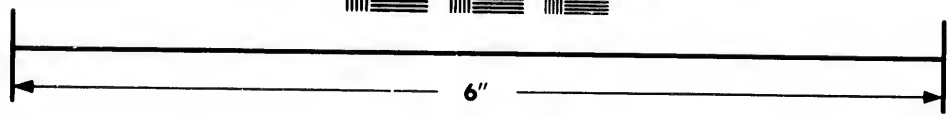
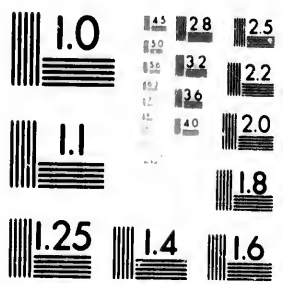


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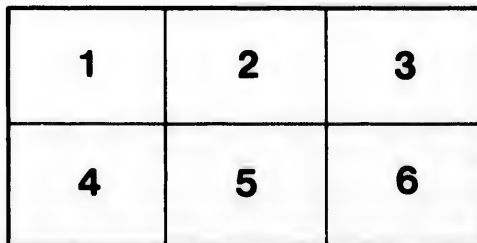
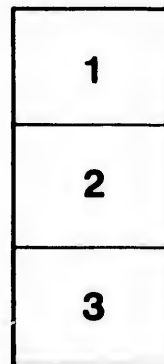
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THE WORK AND WORKERS OF THE  
BRITISH ASSOCIATION FOR THE  
ADVANCEMENT OF SCIENCE

A HISTORICAL SKETCH  
DESIGNED CHIEFLY FOR THE INFORMATION OF THE AFFILIATED  
ASSOCIATES IN BRITISH AMERICA

1831 TO 1884

BY

CORNELIUS NICHOLSON, F.G.S., F.S.A.

*A Life Member for nearly Fifty Years*

MOTTO—'Science is the interpreter of Nature,  
and Man is the Interpreter'

LONDON  
SAMPSON LOW, MARSTON, SEARLE, & RIVINGTON  
188 FLEET STREET  
MONTREAL : DAWSON BROTHERS

1884

LONDON : PRINTED BY  
SPOTTISWOODE AND CO., NEW-STREET SQUARE  
AND PARLIAMENT STREET

## ADVERTISEMENT.

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THE BRITISH ASSOCIATION this year takes a new departure, which may be regarded as a new epoch in its history. For more than fifty years it has travelled, annually, from place to place in the United Kingdom. It now takes a leap to the Dominion of Canada, where the members will be joined by several hundred British American Associates, and where the American Association of Science will be virtually affiliated to the Association. This event seems to justify a retrospect and record of past proceedings and achievements. There are, perhaps, only very few general readers in England thoroughly acquainted with the triumphs of the Association; and as regards the new Associates on the American continent, they may be reckoned to be totally unacquainted with the progress made since the birth of the Association, and desirous of



knowing it. For these reasons, the present publication is issued on the eve of the Congress at Montreal; not without a hope that it may refresh the memories of old Associates, and help new Associates to appreciate the labours of those who have gone before, stimulating them to still higher and nobler work.

ASHLEIGH, VENTNOR :

*June, 1884.*

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TO

PROFESSOR JAMES STUART, M.A.

*Fellow of Trinity College, Cambridge,*

*Professor of Applied Mechanics,*

IN ADMIRATION OF HIS DISTINGUISHED ABILITIES AND  
IN RECOGNITION OF THE GREAT WORK HE IS  
DOING IN ADAPTING THE PRINCIPLES OF  
SCIENCE TO THE USEFUL ARTS,

THIS LITTLE SYNOPSIS

IS

APPROPRIATELY AND AFFECTIONATELY DEDICATED.

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# CONTENTS.

	PAGE
INTRODUCTION . . . . .	1
MATHEMATICS AND PHYSICS . . . . .	6
GEOLOGY . . . . .	18
BIOLOGY . . . . .	22
GEOGRAPHY . . . . .	27
METEOROLOGY . . . . .	31
MECHANICAL SCIENCE . . . . .	35
ECONOMIC SCIENCE AND STATISTICS . . . . .	40
SUBJECTS NOT CLASSIFIED . . . . .	44
NUMBER OF MEMBERS AND FINANCES . . . . .	46
THE WORKERS . . . . .	48
MORAL INFLUENCES . . . . .	54
APPENDIX . . . . .	57

t  
v  
f  
j  
F  
I  
F  
s  
h  
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s  
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WORK AND WORKERS  
OF  
THE BRITISH ASSOCIATION.

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INTRODUCTION.

THE BRITISH ASSOCIATION was born in due time. It arose at the opening of an era whose prevalent characteristics are a craving for facts, a craving for truths objective and subjective, a craving for what Lord Bacon in one phrase called *the 'Advancement of Learning.'* In a career of half a century it has attained a position in the world, and achieved results in science, such as its founders could hardly have predicated. Established in 1831, in the city of York, by a handful of the votaries of science, Sir David Brewster and Professor John Phillips being the prime movers, and Vernon Harcourt its lawgiver, it has grown

with its growth, widening and deepening its course year by year; and, like the British Constitution, has built up its life from conception into law. 'Constitutions make themselves.' As iron sharpeneth iron, the friction of many minds stimulated and matured what isolated efforts would vainly have striven to attain. It has dived into the depths of all branches of science, and brought up treasures for general use and instruction, new facts, new elements, new phenomena. These triumphs are revealed mainly in the *Reports* of Special Committees, one of the chief functions of the Association. In range of subjects it has embraced the whole empire of knowledge, co-extensive with the 'realm of material Nature.' Two subjects only are tacitly excepted from its curriculum—polemics and politics. It has fostered, by its leavening influence, the zeal for scientific and philosophic enquiry outside its circle, both inciting and qualifying general students to appreciate its teachings.

The primary objects of the Association were set forth in a single paragraph in the opening contents of the first volume of its

Transactions in 1831, as follows : ' To give a stronger impulse and a more systematic direction to scientific enquiry ; to promote the intercourse of those who cultivate science in different parts of the British Empire with one another, and with foreign philosophers ; to obtain a more general attention to the objects of science, and a removal of any disadvantages of a public kind which impede its progress.' A more modest programme could hardly be conceived. It might well fail to foreshadow the grasp and scope now reached, the very term *science* being at that time of comparatively limited application. But the foundation was safely laid, though few could prefigure the superstructure. The infant was in swaddlings ; but who, in its juvenescence, could see the promise of stalwart limbs like those of Colossus, which should bestride the Atlantic Ocean ? Periodical change of habitat was a law of its being, and consocial features were not entirely ignored, though quite subordinate ; but no one could dream that what Professor Sedgwick called ' the high flood of kind fellowship ' would reach the shores of the New World, and beget the hospitalities of the



Dominion of Canada. Applying to it a well-known saying of Canning's, the Association now summonses the science of the New World to redress the balance of the Old; and thus takes within its grasp the domains of another hemisphere. So it may well be hailed, as it has lately been, by the magnate of the press, *the world-wide representative of science.*<sup>1</sup>

It was said by a poet in the middle of the eighteenth century that

‘ Life never did to one man allow  
Time to discover worlds and conquer too.’

But this apothegm has been practically disproved in several instances during the half-century, in England, as the Transactions of the Association will show.

Now, looking back, what is the work which the Association has accomplished, or aided in accomplishing? The question is large—the answer difficult. A satisfactory answer, indeed, could only be given by a scientist of many parts. All that can be here attempted in a mind of ordinary culture is to skim the surface of the multitudinous records of the

<sup>1</sup> *The Times*, of September 1883.

Association, and summarise the most striking and salient achievements of the sections, divesting the treatises of their abstruse and technical surroundings. The materials now amount to fifty-three volumes of Transactions, closely printed, each volume being estimated to contain three hundred different notices—a monument of zeal and industry. A further technical difficulty exists in ascertaining the *degree* of progress made in the several sciences during the life of the Association, by reason of the fact that they had already made advances, and none had any defined limits or tide-marks, by which a reckoning of their then status could be made. The notices of such must therefore be, like Wordsworth's 'Excursion,' without beginning or end. Discoveries and inventions since the nonage of the Association are of course exempt from this condition, such as the railway, the telephone, and the spectroscope. Let us endeavour to notice the different subjects, though it can only be skin-deep, and present them in brief but disjointed monographs, adhering to the designations of the sections.

## MATHEMATICS AND PHYSICS.

MATHEMATICS stand foremost among sectional subjects, as 'the portal of Science.' Its pursuit disciplines and qualifies the mind for those special inductive processes by which first principles are drawn to their logical conclusions—enlarging, beyond any other study, the mental horizon. It is, however, the least elastic of the sciences, and least adapted for a historical treatise. Mr. Spottiswoode—a great authority—observed that mathematics lie in an 'enchanted circle'; and it is impossible for one outside that circle to describe its lineaments and functions. Within the principles that govern the science there is immense scope for the solution of problems of highest importance in themselves, and equal importance to the furtherance of other branches of knowledge. Its pursuit is, indeed, necessary for the right comprehension of all natural phenomena. It is satisfactory, therefore, to find that there has been no slack-

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ness in this work. On the contrary, Mr. Spottiswoode affirms that striking progress has been made both in geometry and algebra. In algebra, especially, he says that, to mathematicians at the commencement of this era, the present language and terminology would be almost an unknown tongue. And, not only have derivative forms arisen, previously unnoticed, but these have given expression to many properties of the quantities and their application to fresh problems in physics. It is not impertinent to remark here that Spottiswoode prominently recognises what has been doing in Baltimore in these researches, where, he says, 'a vigorous staff is welding many of these results into a homogeneous mass, as recorded in the "American Journal of Science."' Professor Cayley says that mathematics have never been cultivated more zealously, or with greater success, than in the last half of this century. The advances have been enormous.

The connection between mathematics and physics exists in the fact that all scientific knowledge in relation to physical phenomena depends upon measurements—on number,

quantity, position, and so forth—for which reason, perhaps, these two branches of science are combined in one section; as they are also pursued conjointly by all physiologists into both the quantitative and qualitative conditions of physical phenomena. In this way, as Professor Foster says, mathematical investigations are required at every stage in the development of a knowledge of physics. In this section we must notice three branches of physics which have marched rapidly in parallel lines on their onward way—*Astronomy*, *Chemistry* and *Electricity*.

*Astronomy*.—It is but a truism to say that the fundamental principles on which the science of astronomy—the sublimest of the sciences—is founded, namely, the Copernican system, confirmed and supplemented by Newton's solar theory and law of gravitation, were recognised by all physicists long before the birth of the British Association; but when Sir G. B. Airy was asked by the Association, in 1831, to report on the progress of astronomy in England during the first quarter of the century, he answered 'We have done nothing. In examining the past state

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of the heavens, and making it subservient to a knowledge of the future state, we have contributed nothing.' These shortcomings have, however, since then been amply redressed, and Sir George Airy, when Astronomer Royal, helped materially to reverse the cause of his lament. He penetrated the star depths beyond former researches, and increased the catalogue of stars to an almost incalculable extent. Lord Rosse's telescope<sup>1</sup> was an era in star development. But the most brilliant discovery of the age, perhaps, was by Adams, of Cambridge, who ascertained the existence and the exact position of an unseen planet, Neptune, by the perturbations and peculiar motions of Uranus. The aid of photography was now called in by astronomers ; the Sun's

<sup>1</sup> It is known that the principle of the telescope was accidentally discovered by a spectacle-maker in Holland, who, handling various glasses, incidentally looked through two at once, the one concave and the other convex, placed at different distances. Galileo, who perfected it, gives this origin of the instrument. Sir John Lubbock told the following story at the London University meeting, a short time ago. A lady Academician said of the stars, she was not surprised that astronomers could determine their size and distance and chemical composition, *that* she could understand ; but what she could not make out was how they found out their names !

Corona was photographed without an eclipse, and the star depths were brought on to the collodion plates in the Observatory in the relative distances and positions of the stars. This was proclaimed to be 'unsurpassed by any step of the kind ever yet taken.' The spectroscope was next introduced, which, says Dr. Carpenter, 'has almost given us a new sense, by enabling us to recognise distinctive properties in the chemical elements previously unknown.' The Sun's Corona, with its 'appendage' of rainbow bank of colours, and all the gaseous and metallic constituents of the sun's atmosphere, are transferred to cardboard in perfect *facsimile*. 'We had solar and stellar chemistry,' says Sir William Thomson; 'we now have solar and stellar physiology.' The Moon, again, has been mapped, and the map brought into the laboratory, showing craters and surface features, with changes that are taking place there. A Lunar Committee was appointed by the Association, which devoted much time to this subject with good effect. Attention has recently been given to the laws which may govern the motions of luminous meteors

and comets in their periodical visits, and progress has been made in ascertaining the orbits of these 'wandering stars,' which may perhaps ere long rob them of their *erratic* character. With respect to *light*, there seems to be a consensus of opinion now in favour of which is known as the Undulatory Theory.

*Chemistry.*—The distinguishing work of the age, in chemistry, was the discovery, by *Dalton*, of the Atomic Theory, otherwise called the 'doctrine of multiples' and 'definite proportions.' Dr. Peacock said, at the Congress in York, that this theory 'has totally changed the whole face of the science of chemistry.' It is the law of unity, which displaces the exploded notion of a fortuitous concourse of atoms; the law of the proportionate weights of the elements, which is, for chemistry, what the law of gravitation is for celestial mechanics.<sup>1</sup> And Dr. Daubeny adds his testimony in these words:—'It is a law which not only accommodates itself to all new facts, but is itself the consequence of a still more general principle which philosophers are still

<sup>1</sup> Professor John Phillips.



engaged in unfolding.' In other words, chemists are still working in Dalton's lines, with some slight deviations. Dalton's own example and illustration of his theory is presented in his analysis of water, which he shows to be a binary compound of a single atom of hydrogen and a single atom of oxygen, their relative weights being as 1 to 8.

The most striking development of practical chemistry has been shown in connection with arts and manufactures, notably in the reclamation and utilisation of waste products. Coal-tar was so useless and valueless as to be an incumbrance on gas-works. It was forbidden the refuge of the rivers, and was not worth the labour of the carman, till the chemist discovered its hydrocarbons, which are now converted into benzene and alizarine, and thence into all the brightest colours of the finest dyes. It is calculated that these colouring matters represent a value approaching 5,000,000*l.* sterling per annum.<sup>1</sup>

The practice of medicine, again, has benefited largely at the hands of chemistry. The physician has been greatly aided in the pre-

<sup>1</sup> Sir W. Siemens.

servation and prolongation of life by analyses of alimentary substances under the *microscope*, and especially by the discovery of minute vegetable organisms. It is believed that almost all zymotic diseases have their origin in germs of tubercular growth. A minute germ, called *bacilla*, is found to produce tubercle in the lungs, creating the decay on which it feeds ; so true is the saying that the seeds of life are the seeds of death, and *vice versâ*. Again poisonous substances, heretofore inscrutable, have had their hidden properties several times lately revealed in open court, to the detection and punishment of crime. Again, the *microscope*, with chemical analysis, has revealed marvellous adaptations in the circulation and constituent properties of the blood which is the life of man. No less than eighty millions of corpuscles, red and white—chiefly red—are found in a cubic inch of blood, and each corpuscle has its appointed function. Chemistry tells not only what elements these corpuscles contain, but opens new views as to the relations between human blood and the atmospheric air by which vitality is sustained.

Agriculture has benefited by the application of chemistry to Vegetable Physiology. It was to the Association Congress at Glasgow that *Liebig* first communicated his experiments in this branch of science, which have led to the more philosophical application of stimulants to the soil, the greater fertility of the earth, and the more abundant production of human food.

The dynamical theory of heat has found ample demonstration, and is now recognised by the axiom that heat and force are convertible terms—that matter and energy are co-existent, and indestructible.

*Electricity* is known by its effects, and not by its constituent elements. Its *vera causa* still waits an intelligible definition and description. But, if the source of its inherent power be still a mystery, the measure of its power is revealed, for Sir W. Siemens has declared that, by remarking the lines which separate conductors from non-conductors, physicists can measure electrical quantities with almost mathematical precision. Its measuring instruments, galvanometers, electrometers, and magnetometers are the products of the present

era. A committee of this Association, denominated 'the Unit Committee,' appointed in 1862, promoted this investigation.

The electric telegraph is the practical application of electrical energy. It has a universal audience, coming home, literally, to every man's business and bosom. 'Panting time' lags after it in vain. Its achievements by a single message in one direction were looked on as marvellous, but lately it has out-telegraphed the telegraph by duplex action, signals being passed simultaneously through the same cable in opposite directions, producing, at either end, independent records.

The electric light, as a competitor with gas-lighting, is being gradually developed, and may prove to be a successful competitor, if means of storage can be found, and indefinite distribution in domestic houses be made practicable. The future of electricity cannot be foretold, but this can be said of it already, that no material agent can equal it in the transmission of power to great distances. It furnishes motive power to locomotive engines, sewing machines, and other mechanical agen-

cies; and this conservation of energy is an acquisition of the present generation.

Electricity, again, is the agent actively concerned in the use of the *telephone*—the latest discovery. The action of the telephone has been well described as ‘sound converted into electricity, and electricity re-converted into sound.’ It was brought into public use by Professor Bell of Boston, and improved by Edison of New York. A circumstance occurred in one of the courts of London, in November last, which shows what reliance is placed upon it. A conversation which had been carried on with the witness through the telephone was admitted as legal evidence. The use of the instrument in England is now a monopoly in the power of the General Post Office, and displaces the telegraph in messages of short distances. A great achievement has lately been effected by the simultaneous transmission of a telegraphic despatch in Morse’s signals, and a telephonic message, by one and the same wire!

Perhaps Faraday advanced the knowledge of electricity and electro-magnetism more than any other scientist in this era. He was

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led to infer that as an electric current produced magnetism, so magnetism might produce electric currents; and so, by a series of experiments, he proved his inference, and made the discovery.

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## GEOLOGY.

THE Geological Society of London preceded this Association, but it had not attained to much vigour of life; and one of the first records of the British Association was a lament over the death of 'the father of Geology,' as he was called, *William Smith*. He had done little more than publish some maps, geologically coloured, still his merit was great as a pioneer. *Lyell* had just then published his first edition of 'The Principles of Geology,' and there sprang into activity a host of zealous workers, who simultaneously grappled with the science, and soon brought the 'Archæology of the Globe' under review. The lithological and stratigraphical features of the rocks were first delineated, then classified and denominated, with reference to their organic contents. The construction of railways in England (as told in another place) coincided with the initial efforts of the early geologists, and railway cuttings exposed to view natural sections of

strata heretofore concealed. So the leaves of the book were opened, and Geology took its place among the inductive sciences. What was then styled the Cataclysmal theory was first in vogue—namely, the action of violent disturbances by great forces of Nature since gone to repose. It was seen that a lapse of time, even on those convulsive hypotheses, must be given for the natural history of the earth not reconcileable with the generally received account of creation in the Book of Genesis. This disclosure gave a momentary shock to those who adhered to the verbal inspiration of the Bible; but among the leading geologists were Scripture teachers and preachers (Sedgwick, Buckland, and others), who calmed the fears of the sectaries, and carried a conviction that there need be no antagonism between Geology and Revelation. Geologists consulted the testimony of the rocks as to the genera and species of their organic contents—‘worlds of life created and worlds of life destroyed’—and a gradual succession of types of life was found, in the ascending order, from lower to higher forms. The Cataclysmal theory of rock formations is



now almost universally displaced by what is antithetically styled the 'Uniformitarian theory,' suggested by *Sir Charles Lyell*. All the changes in the earth's crust can be reconciled to physical causes which are still in slow but ceaseless operation. This doctrine, as a matter of course, puts the age of our planet still farther back, without affecting the Mosaic record. Professor Huxley has calculated (what may be hypothetically correct) that, assuming Sir Wm. Thomson's and Dr. Croll's data of the life of the earth at 100,000,000 years, the stratified rocks have been deposited at the rate of  $\frac{1}{100}$ th part of an inch per annum. A striking feature in geology is recognised in the agency of Glaciers. Distinct periods of glacial action are revealed in drift formations and striated rocks. Medial moraines, and the transport of erratic blocks, twenty to fifty miles from the parent rock—attributed by the early geologists to diluvial action—are now referred with confidence to glaciers and floating icebergs, complete confirmation being given to land ice and floating ice still in action in Switzerland, Greenland, and the Himalayas. The oscillations of temperature,

producing ice masses in our latitude, are to be accounted for by the excentricity of the earth's orbit. These intermitting glacial periods were so many episodes in the great epochs of the earth's history. Evidence seems to be still wanting as to whether man had any place on the earth at the occurrence of the last glacial epoch.

The Geological (Ordnance) Survey of England and Wales (now completed) originated with the British Association. It has lately suggested a still bolder project. A Committee has been appointed, with a grant of money, to prepare an *International Geological Map of Europe*. Happy suggestion, to have a Map of the whole of Europe, geologically coloured!

## BIOLOGY.

THE sciences now comprehended under the general title *Biology* consist of Zoology, Botany, Physiology, and Anthropology. If Biology embraces all that is included in the 'science of life and living benefits,' it has regard both to the structure, physiology, and geographical distribution of plants, animals, and man himself. What has excited most interest in recent years in this branch of enquiry is the theory promulgated by *Charles Darwin*, called 'Evolution,' which has become a household word. The main doctrines of Evolution, built up by Darwin on facts and wonderfully minute researches, are accepted by every philosophical naturalist, with scarcely an exception. The inorganic world is interpreted, by this theory, to be a sequence of events proceeding in a direct line from anterior to posterior causation—in plain language, 'one event is the son of another.'

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The types of life in the organic world are also proclaimed to be—not special creations—but the descendants of pre-existing forms, proceeding by 'homogenesis.' Palæontology is cited as confirming these views, and the terrestrial flora contributes like evidence—the lower forms of plant life being recognised as the progenitors of higher types; the cryptogams and flowerless plants preceding, if not also producing, the dicotyledous flowering plants.

*Anthropology*, 'the Science of Man,' belongs to this century, if not to the present generation, if *Blumenbach*, as has been affirmed, first started the investigation. Prehistoric man has engaged much attention, and the enquiry has been rewarded with many disclosures of the highest interest. Cave-dwellings and lake-dwellings have been brought to light, with relics of man and animals so intermingled as to tell the plainest story of an early race of mankind coeval with several extinct animals. Among other relics discovered in the caves were implements and weapons which testify to the first steps in civilisation, and the first rude efforts in cul-

ture.<sup>1</sup> The steps of progress are shown in stone, bronze, and iron, in past life, as decisive as so many pages of chronological history. At and after the dawn of history, the anthropologist grapples with distinct 'phenomena of culture,' beginning with barbarous and semi-barbarous tribes. Civilisation is seen to be developed by gradual steps of progress. Savagery ('slow in the beginning,' says Gibbon) gives place, at length, to tenderness. Disjunctive tribes cohere into communities. Disorder shapes itself into order. Single efforts advance to division of labour. Crass ignorance to useful knowledge. Peoples become Nations. Nations institute Governments, and so cap the climax of the body politic. This sequence of steps in social progression has been worked out, and exhibited in all its phases, by the archæologist, the geologist, the ethnologist, the historian, &c., and the result of their conjoint labours constitutes the history of human life on the globe.

<sup>1</sup> Among the relics at Zurich of prehistoric man, from the lake-dwellings in Switzerland, is a sample of wheat (called dummy wheat), the same as that cultivated by the ancient Egyptians. This looks like a point of contact between the prehistoric and primæval history.

A series of interesting, not to say fascinating Returns, in this department, was contained, at last year's meeting, in a Report of the Anthropometric Committee—namely, the physical characteristics of the population of Great Britain. The general conclusion of the enquiry is that the descendants of those Northern nations of great stature who invaded the British Isles retain for the most part the bulk of the invaders. On the other hand, the Aborigines of Britain, who were of smaller stature, bequeathed their personal peculiarity to their descendants. Further than these racial elements, a comparison is furnished of the average stature, weight, and strength of adult males and females in England; and the stature, weight, and strength of adult males in the several divisions in the United Kingdom. I place the figures in a foot-note.<sup>1</sup> The tallest and strongest examples are found

<sup>1</sup> Adult males average stature 67·36 in., females 62·65 in.; difference 4·71 in. Weight of males 155 lbs., of females 122·8 lbs.; difference 32·2 lbs. Difference in strength is still greater, 35 lbs. relatively, females being only about half as strong as males. With regard to the maturity of growth in height, the conclusion arrived at is that males attain to the maturity of growth at 23 years of age, and females attain their utmost growth at 20.

where they might be sought, in the hilly regions, answering partly to climatic influences, and partly to ancestral inheritance. In an ethnological point of view, complexions in different localities tell the same tale; the varied features being due, as in weight and bulk, to racial origin. In this way ethnological researches tend to illustrate and confirm topographical history.

It will greatly increase the interest of this subject in future if the newly elected members of the Association, resident on the North American continent, would investigate the physical calibre of the population of Canada and the United States, and compare the results with those of the Old World. We should then see what influence, if any, transmigration has had on the physique of the Anglo-Saxon race.

## GEOGRAPHY.

PRACTICAL GEOGRAPHY has been greatly advanced by the activity and enterprise of the age. Both the Arctic and Antarctic Poles have been nearly reached by adventurous explorers, 'where winter barricades the realms of frost.' It was at the instance of this Association that Government sent out the expedition to the Antarctic Continent under Sir James Ross, with Dr. Hooker as scientific observer. All the great mountain ranges in the four quarters of the globe, and all the great rivers, from their deltas up to their springs, have been described and delineated, till it would seem that there is scarcely anything more to discover, and the geographer is in the position of Alexander, sighing for more worlds to conquer.

The several expeditions into Equatorial Africa have excited continued interest. The source of the Nile has been won, and its stream traced for 2,000 miles. The two great



Nyanza reservoirs that feed it, named after the Prince Consort and our British Queen (Albert and Victoria), will for all future time identify the discovery with this age and this reign. The Congo and its waterways have also lately been brought on the canvas, and made familiar almost as the Thames is to a Londoner and the St. Lawrence to a Canadian. These triumphs of discovery, by Livingstone, Speke, Baker, Gordon, and Stanley, bid fair to be crowned ere long by commercial relations, when the lands of Central Africa shall interchange products with all the marts of Europe and America.

Palestine, 'the framework of the canonical Scriptures,' has engaged the labours of several exploring parties, elucidating two branches of knowledge—Archæology and Topography. Captain Conder asserts that they have identified eight-tenths of the ancient Biblical sites of Eastern Palestine, whilst in Western Palestine exploitation has been even more successful. The sites and scenes of Jewish history, as recorded in the Old Testament, the footprints of Christ and His disciples, as related in the New Testament, have been traced and de-

lineated, with these results—namely, a verification of the sacred Scriptures, and an added stimulus to the perusal of the Gospel story.

The Colonial possessions of Great Britain, now comprehended in 'Greater Britain,' have received prominent illustration in their growth within this era. Take one example, perhaps the most striking in civil history. Australia was a 'dark continent' at the inauguration of this Association and was deemed fit only as a place of punishment for convicted felons. It is now, by immigration and a fine climate, a wealthy and formidable nation of Anglo-Saxons. It has a population of nearly 4,000,000. The value of the trade between the mother-country and Australasia amounts to 45,000,000*l.* sterling, and the total imports and exports to 115,000,000*l.*<sup>1</sup> The several Colonies are now passing into a Confederate State on the lines of the Dominion of Canada.

Homer's place in topographical history has been sought and identified by the indefatigable labours of Dr. Schliemann.

Lastly, a great step in geography was

<sup>1</sup> Sir H. Parkes, ex-President of New South Wales.

projected by an International Commission which assembled last October in Rome—namely, that there shall be an *initial meridian* for both longitudes and times of day, and *Greenwich* is fixed upon for the standard. Henceforth, therefore, there will be one ruling minute of time, in every civilized State on the globe—an incalculable advantage to science, to navigation, and to commerce.

## METEOROLOGY.

ONE of the earliest recommendations of the Association at its first Congress was 'that systematic direction be given to the study of meteorology.' At that time it was said by Professor Forbes that meteorological instruments were treated like toys. Dr. Dalton had, a few years previously, in a publication entitled 'Meteorological Observations,' promulgated his theory of the fall of rain—that rain occurs by aqueous vapour in fields of air being acted upon by pressure and changes of temperature. Dalton had registered the rainfall in Kendal, in Manchester, and on Helvellyn; but he had few, if any, disciples until they arose from the ranks of the British Association. If meteorology be rightly described as 'a science of detail,' it is because the agents which produce its phenomena are so numerous, and the observations to understand the phenomena require to be so many and so widely placed.

The Association united terrestrial magnetism with meteorology in 1838. It afterwards called the attention of the British Government and that of several foreign Governments to the necessity of mutually established stations of observations. These suggestions were favourably received and responded to by Russia, Austria, Prussia, Belgium, and our own Government; co-operation was thus secured in these States, and so many Observatories put into intercommunication.

Mr. Glaisher essentially promoted investigations in this science by his balloon ascents into the upper regions of the atmosphere of the earth, and his original observations on rain-clouds and fields of snow.

The discovery of the rotatory or revolving course of storms belongs to this era; so also does the invention of the anemometer, which tells the force and speed of the winds. This instrument measures and registers the force, the velocity, and the direction of the winds; all-important, therefore, is its instrumentality. The establishment of a network of stations of observations at New York, Montreal, Nova Scotia, the West Indies, along the coasts of the

Atlantic, Newfoundland, &c., in communication by telegraph with stations planted at different places and different altitudes in Europe, have enabled forecasts of storms, especially those coming towards the British Isles with south-west winds, to be made with almost unerring accuracy. This combination, indeed, converts the forecasts of weather in England into a gratuitous insurance of life and property.

We have been taught, in this enquiry, to what degree the temperature of our climate is ameliorated by the heated waters of the Gulf Stream. Dr. Lloyd found the mean temperature of the sea off the west coast of Ireland  $4^{\circ}$  higher than that of the land.

Dr. Dalton constructed, with his own hands, one of the first rude rain-gauges. Now the perfected instrument for ascertaining the fall of rain is employed by voluntary observers in every district of Great Britain. The mean fall of rain in the United Kingdom is within a fraction, under or over, of 35 inches.

There has recently been established on Ben Nevis, 4,400 feet above the level of the sea, a permanent magnetic and meteorological

station, in the very track of the Atlantic storms. This Association made a grant of money in 1882 to promote observations on Ben Nevis.

## MECHANICAL SCIENCE.

It was not till 1837 that the Mechanical Section was established, since which it has attracted contributions from all the most distinguished engineers and mechanics of the age. The Czar, *Peter the Great* (a voluntary artizan in England at the time), enquired, at the workshop of Watt, in Birmingham, what was made there? The answer was Power! That one word 'Power' embodies and characterises the era under review. The consummation so devoutly wished by Archimedes has been virtually realised. The properties and powers of iron and steel have been more than quadrupled. Robert Stephenson threw a Tubular Bridge of iron, two hundred feet high, across the Menai Straits, in 1850, as if it had been a hand ball. Nasmyth produced a steam hammer which can fall with a force of ninety tons or crack a nut at the pleasure of the manipulator. Hand labour has been superseded to an incalculable extent by the application of mechanical



processes, to the increase and economy of production. In 1838, the first steam vessel achieved the voyage of the Atlantic at nine knots an hour, with the utmost pressure of steam of 20 lb. to the inch. Since then, speed has risen to twenty knots an hour, and the pressure of steam to 75 lb. an inch, with a saving of more than two-thirds the consumption of coal. Then, again, the progress of mechanical appliances may be exemplified by the history of the Submarine Telegraph. A steam vessel of 2,600 horse-power, with special provisions for the work, carried a cable 2,300 miles long, depositing it on the floor of the Atlantic; a breach of continuity occurred in the conducting wires—the fracture was detected, the cable was fished up from a depth of 2,000 fathoms, and successfully relaid. Every civilised State in the four quarters of the globe is now in intercommunication by means of the telegraph.

The establishment of railways synchronised with the birth of this Association, the first passenger line being opened in 1830. The first Bill seeking legislative powers was defeated because the scheme was declared to be

utopian. George Stephenson was called a wild enthusiast when, in pleading for the preamble of the Bill, he declared his belief that railway trains would be made to travel at the rate of twelve miles an hour! To tell now of the universal adoption of the railway would be surplusage.<sup>1</sup> The capital now employed beneficially in the railways in the United Kingdom is 700,000,000*l.* sterling. With respect to the personal safety in railway travelling, a calculation, based on experience, was made by Sir John Hawkshaw, that a person may travel 100,000 miles every year for forty years, and the chances are in his favour without encountering an accident.

In Europe, railway travelling has reached this stage, that you can pass from London to Constantinople within ninety hours.

On the continent of America there will be, in a short time, no fewer than ten trans-continental railways across the Dominion and the States, binding together the Atlantic

<sup>1</sup> The most rapid, perhaps too rapid, growth of railways has taken place in the United States. Between 1840 and 1843 the railway mileage grew from 1,000 miles to 150,000 miles, an evidence of progress that has no parallel in history.

and Pacific Oceans, by forty iron rods, 3,000 miles long.

Mechanism connected with the Press has progressed equally with its application to other industrial arts. Formerly a hand printing press could barely produce 250 moderately sized sheets an hour. Now the machine called the Walter Printing Press, in the *Times* Office, throws off 12,500 copies of that large paper in an hour, folding them neatly as it throws them off. But the system of furnishing Parliamentary reports by the *Times* shows, perhaps, the most advanced practical adaptation of mechanical appliances in connection with the telephone. The reporter in the House of Commons, sitting within ear-shot of the speakers, has an intelligent lad by his side, to whom he pushes his short-hand slips; that lad forwards the sentences through the telephone to the ears of another lad who is seated at a composing machine in Printing House Square, the latter of whom, without any manuscript copy, sets up the type at the rate of 230 lines of a column per hour. A hand compositor can do about forty lines per hour. Thus, and thus alone, debates up to between two and

three o'clock in the morning are daily despatched to all parts of the kingdom by the five-o'clock express trains.

A feature of the age is the recognised union of the mechanical arts with the principles of science. The working mechanic has now given to him, chiefly by recently introduced extra-university teaching, an elementary knowledge of the laws that govern the material on which he is operating. Professor Stuart, of Cambridge (for whom a special chair was created), is daily exemplifying this important feature in applied mechanics. Thus theory and practice, science and art are brought into mutual dependence and reciprocal action.

## ECONOMIC SCIENCE AND STATISTICS.

THE section devoted to the pursuit of the many branches of enquiry under the title of 'Economic Science' had no place in the Association in its early days. 'Statistics' opens out a broad field, embracing all facts within the range of individual life and the life of the nation. No wonder, then, that it was no sooner introduced than it attracted numerous devotees, and grew to large dimensions. The supply of food, the consumption of food; the accumulation of wealth, and the relations of wealth to other commodities; Boards of Health, bills of mortality, Board schools, poor laws, industrial dwellings, pollution of rivers, sanitary provisions, domestic architecture, imports and exports, joint-stock companies, crime, judicial punishment, coinage, currency, savings banks, smoke prevention, water supply, sociology, and a multitude of other subjects, have occupied the attention of members in this section. It may suffice to notice

here only the figures which tell the growth of the United Kingdom in population and wealth, and the growth of intelligence by the increase of postal communication.

*Population and Wealth.*—Since the early part of the century the population of Great Britain has increased from sixteen millions to more than thirty-five millions; and the national income has in the same time increased from 250,000,000*l.* to more than 1,200,000,000*l.* sterling—four-fold and upwards.<sup>1</sup>

In the last fifty years, the Imperial taxation averaged 40*s.* 10*d.* per head of the whole population. [In France it is 51*s.* 6*d.*] Separating these taxes into classes, of the 40*s.* 10*d.* average, the upper and middle classes pay 66*s.* per head, and the lower classes 26*s.* per head. The paupers who pay no taxes exceed 1,000,000 persons.

*Merchant Shipping.*—The progressive increase in British merchant shipping is shown in few figures. In 1840 the tonnage of British ships was 6,490,485 tons. In 1883 the tonnage of British ships had risen to 47,039,079!

<sup>1</sup> Board of Trade Returns.

*Postal Communication.*—The most powerful stimulant ever applied, in civil society, to the spread of education, and the cultivation of family and social intercourse, was the establishment of the Penny Postage in 1840.

Letters now passing through the Post Office	1,300,000,000
Post Cards                   "                   "	144,000,000
Book Packets and Circulars                   "                   "	300,000,000
Newspapers                   "                   "	150,000,000
Altogether	<u>1,894,000,000</u>
Telegraph messages through the Post Office	40,000,000

The amount of deposits in the Post Office Savings Bank is nearly 20,000,000*l.*, and the return shows that there is one depositor for every ten of the population; 4,069 letters pass through the Post Offices in England and Wales to every 100 of the population. In other words, every person contributes forty letters in a year on the average.

*National Income.*—The income of the United Kingdom in 1881 was 1,280,000,000*l.*

The *Revenue* of the United Kingdom in 1883 was 89,004,456*l.*

The *Imports* and *Exports* of the United Kingdom, added together, amount to 719,680,322*l.*

The practical development of economic science is seen and felt by all nations in the universal interchange of commodities which contribute to the comfort and convenience of man. The native products of every zone, and the manufactured products of every race and nation, are distributed lavishly, and enjoyed alike by all, producer and consumer, however distant from each other. In no other respect can social progress be so accurately measured and illustrated. Tariffs cannot hinder the distribution or the use of supplies which civilization, ever on the increase, demands. And the facilities which have produced this universal diffusion and universal interchange of the necessaries of life must rank among the highest gifts of science.



## SUBJECTS NOT CLASSIFIED.

SEVERAL objects of enquiry and of great general interest have from time to time engaged the attention of the Association, but which, although duly recorded in the Transactions, are obliged to be placed outside the technical designations of the sections; such, for example, are observations on the migrations of birds. A Committee of Members versed in Natural History has been engaged, since 1882, in collecting facts and observations, mainly at lighthouses and light-ships, on the periodical migration of birds to and from the British Islands. The Committee has succeeded in accumulating a large number of facts which could never, perhaps, have been obtained by other instrumentality, but they nevertheless hesitate at present, to make any general deductions on the uniformity of migrant habits, and ask for time to collect still more data. This much is already made clear, that the highways or lines of migration

adopted by birds are from W. and N.W. to E. and S.E. *in the Spring*; and from N.E. and E. to W. and N.W. *in the Autumn*. The number of migrants and their times of flitting are governed, in degree, by the prevalence of high winds, and variations of temperature, as might naturally be expected. It may be added that there are no less than 228 light-houses and light-ships around the coasts of Great Britain and Ireland :—

‘ Northwards towards the cool spring weather,  
Flocks of migrants fled together,  
On to England o’er the sea  
Where all folks alike are free ;  
But, in autumn, south they go  
Past the Straits, and Atlas’ snow,  
Over desert, over mountain,  
To the palms beside the fountain.’<sup>1</sup>

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<sup>1</sup> Charles Kingsley

## NUMBER OF MEMBERS AND FINANCES.

A VERY few figures will suffice to show the progress of the Association in its augmentation of numbers, and the steady increase of its finances. In the first year of its existence the number of members was 353. We are unable to show the growth of members year by year, because for four years no record was made. So, lacking these, and dividing the aggregate of forty-eight years to get an *average*, there is exhibited an increase of members from 353 in the first year to an average in the following years of 1781.

With regard to finances, the year 1848 was the first time that the amount received at a congress was recorded. In that year 707*l.* was received. In the thirty-five years following—from 1848 to 1883—the yearly receipts increased from 707*l.* to an *average* of 2,060*l.* These funds proceed from life subscriptions and annual subscriptions; and the money has been disbursed in grants to special

committees for experiments and reports on different branches of science, for the construction of instruments, &c. &c. In a few instances only has the National Exchequer been appealed to for aid, and then only for national objects. Thus the voluntary and independent character of the Association has been strictly maintained, whilst all the labours of its members have been gratuitously bestowed. So, to quote an eulogium of the late Prince Consort, the Association has 'made its way in the world by its own efforts.'

## THE WORKERS.

SUBJOINED is a list of those members who rank most conspicuously in the proceedings of the Association ; and it is not too much to assume that there never before was presented in one sheet such a conjunction of great intellects engaged in a common object. There have been many other contributors to sectional subjects besides these in the life of the Association ; but the list contains the names of those in the front rank who most distinguished themselves, and are themselves most distinguished. The names of foreigners are in italics.

## PRESIDENTS OF MEETINGS.

*In chronological order.*

Earl Fitzwilliam, Dr. Buckland, Professor Sedgwick, Sir T. Brisbane, Dr. Provost Lloyd, Marquess Lansdowne, Earl Burlington, Duke of Northumberland, Vernon Harcourt, Marquess Breadalbane, Dr. Whewell, Lord F. Egerton, Earl Rosse, Dr. Peacock, Sir J. Herschel, Sir R. Murchison, Sir Harry Inglis, Marquess

Northampton, Dr. Robinson, Sir D. Brewster, G. B. Airy, Colonel Sabine, Professor Hopkins, Earl Harrowby, Duke of Argyll, Dr. Daubeny, Dr. Humphrey Lloyd, Professor Owen, H. R. H. Prince Consort, Lord Wrottesley, Sir W. Fairbairn, Professor Willis, Sir W. Armstrong, Sir Charles Lyell, John Phillips, W. R. Grove, Dr. Hooker, Professor Stokes, Professor Huxley, Sir William Thomson, Dr. W. B. Carpenter, Professor Williamson, Professor Tyndall, Sir J. Hawkshaw, Professor J. Andrewes, Professor A. Thomson, Dr. Spottiswoode, Professor Allman, Professor Ramsay, Sir John Lubbock, Dr. Siemens, Professor Cayley, PROFESSOR LORD RAYLEIGH (present President).

## COADJUTORS.

Dr. Dalton, Sir Philip Egerton, Samuel Taylor Coleridge, Sir C. Lemon, Bishop Wilberforce, *De la Bèche*, Charles Darwin, Professor Faraday, Professor J. D. Forbes, Professor Wheatstone, Sir Benjamin Heywood, Professor J. C. Adams, Right Hon. W. E. Gladstone, Sir Joseph Whitworth, Joseph Prestwich, Professor Odling, Dr. Robinson, Professor Powell, W. S. Harris, Professor M'Culloch, W. De la Rue, Professor T. Graham, Dr. Lyon Playfair, Professor W. A. Miller, Dr. Bence Jones, Dr. W. Herapath, Dr. Golding Bird, Dr. Gladstone, Professor Frankland, Dr. Davy, Professor Liveing, Dr. A. Cwm Brown, W. H. Perkin, Dr. Armstrong, Dr. Eaton,

*Professor Von Middendorff*, Dr. Mantell, *Agassiz*, *Le Verrier*, Hodgkinson, Lord Brougham, *Lavoisier*, Dr. Scoresby, William Yarrell, *Encke*, *Bessel*, *Bache*, Richard E. Griffith, G. B. Greenough, H. E. Strickland, E. W. Binney, R. Hutton, H. Warburton, M.P., Leonard Horner, William Hopkins, Edward Forbes, Lord Talbot de Malahide, J. Beete Jukes, Warrington W. Smyth, Professor Nicol, Professor Harkness, H. C. Sorby, Gilbert Saunders, T. Rupert Jones, Thomas Sopwith, Professor Hawkins, Godwin Austen, Professor Pengelly, Dr. John Evans, R. Etheridge, Henry Woodward, W. Topley, Professor Babington, E. Forbes, Dr. Lankester, Professor Henslow, Sir John Richardson, T. V. Wollaston, William Spence, Professor Balfour, Dr. Fleming, Thomas Bell, Sir W. Jardine, Dr. Russell, Dr. J. Abercrombie, Dr. T. Alcock, Professor Flower, C. Spence Bate, Professor Rollaston, Professor Wyville Thomson, Colonel Lane Fox, P. L. Slater, J. Gwyn Jeffreys, F. Galton, E. B. Tylor, Dr. Pye Smith, Dr. J. S. Cobbold, Sebastian Evans, E. R. Alston, Hyde Clarke, Professor McNab, W. Bloxam, Professor Gamgee, Dr. Roget, Professor Ogle, Sir Benjamin Brodie, Sir James Paget, Dr. R. S. Sargent, James Glaisher, *Arago*, Dr. Pritchard, Colonel Chesney, Sir H. C. Rawlinson, Sir James Clerk Ross, Sir Samuel Baker, Dr. Norton Shaw, Professor Geddes, Thomas Wright, C. R. Markham, *Liebig*, Sir Bartle Frere, Sir Rutherford Alcock,

Professor Babbage, Colonel Sykes, W. R. Greg, J. W. Barry, Dr. W. Cooke Taylor, G. R. Porter, Travers Twiss, Nassau W. Senior, Edwin Chadwick, William Tite, Dr. W. Farr, W. Stanley Jevons, Professor H. Fawcett, G. Shaw Lefevre, Professor Cairns, Professor Leone Levi, Grant Duff, Selater Booth, Professor Willis, Sir J. Macneill, Robert Stephenson, J. Scott Russell, Sir George Rennie, J. F. Bateman, G. Baden Powell, Rev. W. T. Kingsley, Sir W. G. Armstrong, Thomas Hawksley, G. P. Bidder, W. H. Barlow, H. M. Brunel, J. N. Shoolbred, Sir M. J. Brunel, Dr. Falconer, Hugh E. Strickland, Rev. Dr. Livingstone, Captain Sherard Osborne, Professor W. A. Miller, Archibald Geikie, E. B. Tylor, Professor Tait, Professor Dewar, Professor Boyd Dawkins, W. E. Ayrton, G. H. Darwin, *Professor Baumhauer*, R. Etheridge, Professor J. Prestwich, Sir R. Temple, Captain Douglas Galton, F. Darwin, J. Norman Lockyer, Dr. H. C. Sorby, *C. E. de Rance*, W. Topley, R. J. Ussher, Dr. Beddoe, J. Park Harrison, Professor Newton, Percy Sladen, Sir John Bowring, Mrs. Fawcett, *Elie de Beaumont*, Dr. Burdon Sanderson, Dr. Gunther, P. L. Selater, A. T. Atchison, Sir Joseph Whitworth, H. Trueman Wood, Dr. A. Muirhead, Professor Sylvester, Professor Schuster, Professor F. C. Foster, Captain Abney, Dr. Marshall Watts, H. B. Dixon, Professor Dewar, W. D. Chandler Roberts, W. J. Sollas, Rev. H. W. Crosskey, *Dr. G. Hartlaub*,



Rev. Canon Tristram, Miss Lydia E. Becker, Professor Roscoe, H. Brabrook, W. H. Barlow, Professor W. A. Tilden, Professor V. Ball, General Pitt-Rivers, Professor H. N. Moseley, *Professor J. W. Mallet, Professor H. Alleyne Nicholson*, Professor Griffith, H. M. Stanley, Henry Woodward, Rev. W. Greenwell, C. Roberts, Professor Jevons, Professor Dewar, Professor H. G. Seeley, James Spencer, Alfred W. Beunett, Miss A. W. Buckland, Professor J. McK. Hughes, F. Galton, H. Woodward, W. R. Birt, D. T. Ansted, James Abernethy, *Dr. Gunther*, G. J. Symons, Professor P. S. Tait, J. T. Bottomley, C. M. Stuart, Dr. W. Huggins, Professor Foxwell, *Professor Roemer*, J. W. Salter, *Bunsen*, General Sir T. Brisbane, Dr. Chalmers, Peter Clare, Rev. W. D. Conybeare, Earl Ellesmere, Professor E. Forbes, G. B. Greenough, Sir William Hamilton, Professor Henslow, Leonard Horner, Professor Jameson, Sir Charles Lemon, Professor MacCullagh, Viscount Palmerston, Sir Robert Peel, Sir John Rennie, Earl Rosse, H. Warburton, Captain Sir John Ross, *Ehrenberg, A. von Humboldt, Professor H. D. Rogers*, Professor Johnston, Francis Bismoch, Professor Henrici, *Erichsen, Bessel*, Luke Howard, *Quetelet*, Snow Harris, *Yarrell*, Faraday, *Professor Nillson, Charles Buonaparte, Maury*, Dr. Lardner, *Professor Schonbein*, Francis Bailey, Professor De Morgan, *Piazzi Smyth*, Dr. Beust, Robert Chambers, *Werner Siemens*, J. P.

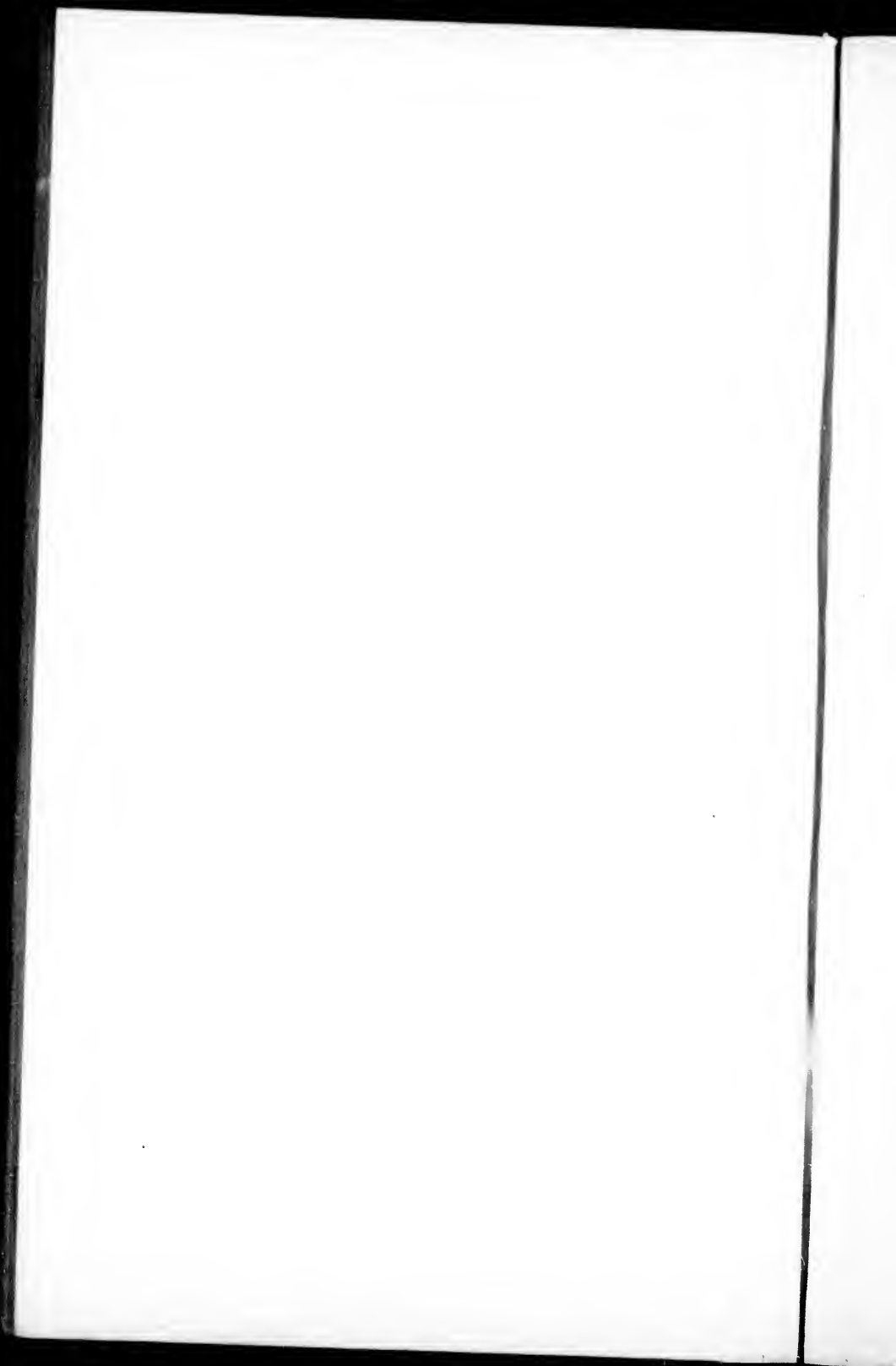
Gassiot, Dr. Davy, *Du Chaillu*, Professor Buckman, Lord Stanley, Hugh Miller, Captain Fitzroy, Sir E. Belcher, C. Roach Smith, Thomas Wright, C. B. Hue, Charles Simeon, *Dufrenoy*, James Nasmyth, *Voelcker*, J. Craufurd, Professor Foster, *Sir William Logan*, Professor Lawson, Sir Stafford Northcote, E. Whymper, J. E. H. Gordon, Vernon Harcourt, Professor Redfern, Sir W. R. Wilde, P. Martin Duncan, *Dr. Janssen*, Professor Jellett, PROFESSOR BONNEY (present Secretary).

## MORAL INFLUENCES.

It is not contended that the British Association has been the originator of all those steps of mental, material, and social progress that have characterised the half-century. But it has originated many, and has fostered and encouraged still more. If it has not opened, it has at least enlarged the openings of, the fountains of knowledge. It has 'cleared the ways, and removed the obstacles from the paths of science.'<sup>1</sup> And beyond these material influences, it has had beneficial moral effects on its members that cannot be over-valued. Let us tell this in the eloquent language of Sir John Herschel, which will heighten the sentiment. He says, 'Let selfish interests divide the worldly; let jealousies torment the envious; we breathe a purer Empyrean. The common pursuit of truth is of itself a brotherhood. In these meetings we have a source of delight which draws us together,

<sup>1</sup> Professor John Phillips.

and inspires us with a sense of unity. That astronomers should congregate to talk of stars and planets; chemists, of atoms; geologists, of strata, is natural enough: but what is there, equally pervading all, which causes their hearts to burn within them for mutual unbosoming? Surely the answer of each and all, the chemist, the astronomer, the physiologist, the electrician, the biologist, the geologist, all with one accord, and each in the language of his own science, would answer, not only the wonderful works of God, and the delight their disclosure affords, but the privilege he feels to have aided in the disclosure. We are further led to look onward through the vista of time with chastened assurance that science has still other and nobler work to do than any she has yet attempted.'



## APPENDIX.

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It may naturally be supposed—what experience has shown—that the meetings of the British Association, itinerating yearly, exhibit various degrees of general interest according to time, place, and existing circumstances. In some instances, the Congress has been distinguished by the presence of philosophers of world-wide fame, as when *Dalton*, the great English chemist, and *Arago*, the renowned French savant, gave éclat to the Congress at Manchester in 1842; and again at Brighton, in 1872, when H. M. Stanley was announced as a speaker, to give his startling account of his first meeting in Africa with the long-lost *Livingstone*. The largest hall in Brighton was crammed to the doors with an array of ladies and gentlemen such as had not there been seen before or since. Stanley was placed on a platform in company with Dr. W. B. Carpenter, the President, and the rest of the Presidents and Secretaries of sections, and just as the proceedings were about to begin, an exciting hush and murmur stirred the air as the ex-Emperor of the French, the Empress Eugénie and the young Prince Imperial

took seats immediately under the platform. Stanley, with great ease and fluency, described his then perilous journey from Zanzibar across the African desert, through swamp and jungle and mountain ranges, until he reached an eminence which overlooked Ujiji, where, to his astonishment, there came up to him a white man, who accosted him in English, with 'Good morning.' Enquiring of Stanley what was his enterprise, the answer was, 'I am in search of Dr. Livingstone.' 'Oh! if that is it, go with me down to yonder huts, and I will show you Dr. Livingstone.' 'So we two went down, and approaching a hamlet of huts, by a scattered flock of ebony-coloured women and children, I came upon an aged white man with lean and slippered pantaloons and long grey beard, when the following dialogue took place between us. Lifting my uncouth bonnet, I asked, "Is this Dr. Livingstone?" "I am indeed Livingstone; and who may you be?" "I am Stanley, the adventurous agent of the 'New York Herald,' and my errand has been to find you." "Well, come into my bungalow, and let us have a chat. Tell me first, before you refer to New York affairs, what is the latest news from Europe." "Europe has been convulsed. Dynasties have been overthrown, and the map, in the centre of it, has been considerably altered. A fierce but sharp and decisive war has been waged between France and Germany, in which all the armies of France were licked into a cocked hat in one campaign. The Germans, after win-

ning several battles, imprisoned 30,000 French soldiers in Metz, and encircled it with a girdle of steel ; then the Emperor of the French surrendered his sword without conditions to the King, now the Emperor of Germany, and Napoleon III. is at this moment *a refugee in England!*''' At these words the ex-Emperor started, and a thrilling sensation, like an electric shock, ran through the vast audience. It was a *coup de théâtre*, and Stanley's manner of delivery left little doubt that the recital was intended for effect, and effected what was intended. Many grave doubts had previously to this been entertained of the reality of Stanley's adventures and his discovery of Livingstone ; but these doubts were entirely dissipated by the naïve way in which he told his story. It is not too much to say that he who (as he himself said) had never seen a map of Africa till he was on his first journey towards the Equator, has now proved himself one of the main instruments in solving the great problem which Livingstone set for solution in physical geography.



