



INTRODUCTION.

PART I.

BIOGRAPHICAL.

It is an open secret to the few who know it, but a mystery and a stumbling-block to the many, that Science and Poetry are own sisters; insomuch that in those branches of scientific inquiry which are most abstract, most formal, and most remote from the grasp of the ordinary sensible imagination, a higher power of imagination akin to the creative insight of the poet is most needed and most fruitful of lasting work. This living and constructive energy projects itself out into the world at the same time that it assimilates the surrounding world to itself. When it is joined with quick perception and delicate sympathies, it can work the miracle of piercing the barrier that separates one mind from another, and becomes a personal charm. It can be known only in its operation, and is by its very nature incommunicable and indescribable. Yet this faculty, when a man is gifted with it, seems to gather up the best of his life, so that the man always transcends every work shapen and sent forth by him; his presence is full of it, and it lightens the air his friends breathe; it commands not verbal assent to propositions or intellectual



acquiescence in arguments, but the conviction of being in the sphere of a vital force for which nature must make room. Therefore when, being happy in that we knew and saw these things, and have received the imperishable gifts, we must unhappily speak of the friend who gave them as having passed from us, it becomes nothing less than a duty to attempt the impossible task; to describe that which admits of no description, and communicate that for which words are but blundering messengers. And perhaps it may not be in vain; for a voice which is in itself weak may strengthen the kindred notes that vibrate in other memories touched by the same power, and those we know to be very many. For this power, when it works for fellowship and not ambition, wins for its wearer the love of all sorts and conditions of men, and this was marked in Clifford by all who had to do with him even a little. More than this, our words may peradventure strike farther, though by no force or skill of their own, and stir some new accord in imaginations favourably attuned for the impulse. The discourses and writings collected in this book will indeed testify to the intellectual grasp and acuteness that went to the making of them. Clifford's earnestness and simplicity, too, are fairly enough presented to the reader, and the clearness of his expression is such that any comment by way of mere explanation would be impertinent. But of the winning felicity of his manner, the varied and flexible play of his thought, the almost boundless range of his human interests and sympathies, his writing tells—at least, so it seems to those who really knew him—nothing or very little. To say a word or two in remembrance of one's

friend is but natural; and in these days excuse is hardly needed for saying it in public. But here this is the least part of the matter in hand. Personal desires and aims are merged in the higher responsibility of telling the world that it has lost a man of genius; a responsibility which must be accepted even with the knowledge that it cannot be adequately discharged.

Not many weeks had passed of my first year at Trinity when it began to be noised about that among the new minor scholars there was a young man of extraordinary mathematical powers, and eccentric in appearance, habits, and opinions. He was reputed, and at the time with truth, an ardent High Churchman. I think it was then a more remarkable thing at Cambridge than it would be now, the evangelical tradition of Simeon and his school being still prevalent. This was the first I heard of Clifford; and for some two years he continued to be nothing more to me than a name and a somewhat enigmatic person. In the course of our third year circumstances brought us together: it is difficult to remember the beginnings of a friendship that seems as if it must always have been, but to the best of my recollection there was nothing very sudden or rapid in our closer approach. I should assign about six months as the interval filled by the transition from acquaintance to intimacy. At an early stage in my knowledge of him I remember being struck by the daring versatility of his talk. Even then there was no subject on which he was not ready with something in point, generally of an unexpected kind; and his unsurpassed power of mathematical exposition was already longing to find exercise. I shall be pardoned for giving a concrete instance which



may be in itself trivial. In the analytical treatment of statics there occurs a proposition called Ivory's Theorem concerning the attractions of an ellipsoid. The text-books demonstrate it by a formidable apparatus of co-ordinates and integrals, such as we were wont to call a *grind*. On a certain day in the Long Vacation of 1866, which Clifford and I spent at Cambridge, I was not a little exercised by the theorem in question, as I suppose many students have been before and since. The chain of symbolic proof seemed artificial and dead; it compelled the understanding but failed to satisfy the reason. After reading and learning the proposition one still failed to see what it was all about. Being out for a walk with Clifford, I opened my perplexities to him; I think I can recall the very spot. What he said I do not remember in detail, which is not surprising, as I have had no occasion to remember anything about Ivory's Theorem these twelve years. But I know that as he spoke he appeared not to be working out a question, but simply telling what he saw. Without any diagram or symbolic aid he described the geometrical conditions on which the solution depended, and they seemed to stand out visibly in space. There were no longer consequences to be deduced, but real and evident facts which only required to be seen. And this one instance, fixed in my memory as the first that came to my knowledge, represents both Clifford's theory of what teaching ought to be, and his constant way of carrying it out in his discourses and conversation on mathematical and scientific subjects. So whole and complete was the vision that for the time the only strange thing was that anybody should fail to see it in the same

way. When one endeavoured to call it up again, and not till then, it became clear that the magic of genius had been at work, and that the common sight had been raised to that higher perception by the power which makes and transforms ideas, the conquering and masterful quality of the human mind which Goethe called in one word *das Dämonische*.

A soul eager for new mastery and ever looking forward cares little to dwell upon the past; and Clifford was not much apt to speak of his own earlier life, or indeed of himself at all. Hence I am indebted to his wife and to other friends for what little I am able to say of the time before I knew him. William Kingdon Clifford was born at Exeter on May 4, 1845; his father was a well-known and active citizen, and filled the office of justice of the peace. His mother he lost early in life; he inherited from her probably some of his genius, and almost certainly the deep-seated constitutional weakness, ill paired with restless activity of nerve and brain, which was the cause of his premature loss. He was educated at Exeter till 1860, when he was sent to King's College, London, not without distinction already won in the University Local Examinations. At school he showed little taste for the ordinary games, but made himself proficient in gymnastics; a pursuit which at Cambridge he carried out, in fellowship with a few like-minded companions, not only into the performance of the most difficult feats habitual to the gymnasium, but into the invention of other new and adventurous ones. But (as he once said himself of Dr. Whewell) his nature was to touch nothing without leaving some stamp of invention upon it. His accomplishments of



this kind were the only ones in which he ever manifested pride. When he took his degree there was a paragraph in 'Bell's Life' pointing out, for the rebuke of those who might suppose manly exercises incompatible with intellectual distinction, that the Second Wrangler, Mr. Clifford, was also one of the most daring athletes of the University. This paragraph gave him far more lively pleasure than any of the more serious and academical marks of approval which he had earned. In 1869 he wrote from Cambridge :—'I am at present in a very heaven of joy because my corkscrew was encored last night at the assault of arms : it consists in running at a fixed upright pole which you seize with both hands and spin round and round descending in a corkscrew fashion.' In after years he did not keep up his gymnastic practice with anything like regularity ; but he was with great difficulty induced to accept the necessity of completely abandoning it when it was known to be positively injurious to his health. A friend who was his companion in gymnastics writes to me :—'His neatness and dexterity were unusually great, but the most remarkable thing was his great strength as compared with his weight, as shown in some exercises. At one time he could pull up on the bar with either hand, which is well known to be one of the greatest feats of strength. His nerve at dangerous heights was extraordinary. I am appalled now to think that he climbed up and sat on the cross bars of the weathercock on a church tower, and when by way of doing something worse I went up and hung by my toes to the bars he did the same.'

At King's College Clifford's peculiar mathematical

abilities came to the front, but not so as to exclude attention to other subjects. He was at various times and in various ways marked out for honourable mention in classics, modern history, and English literature. His knowledge of the classics, though he did not cultivate the niceties of scholarship, was certainly as sound and extensive as that of many professedly classical students ; and, like all his knowledge, it was vital. If he made use of it for quotation or otherwise, it was not because the passage or circumstance was classical, but because it was the thing he wanted to illustrate his own thought. Of history he knew a good deal ; he was fond of historical reading throughout his life, and had a ready command of parallels and analogies between widely remote times and countries, sometimes too ingenious to bear criticism. I doubt if he studied historical works critically ; it seems to me that he regarded history in a poetical rather than a scientific spirit, seeing events in a series of vivid pictures which had the force of present realities as each came in turn before the mind's eye. Thus he threw himself into the past with a dramatic interest, and looked on the civilized world as a field where the destinies of man are fought out in a secular contest between the powers of good and evil, rather than as a scene of the development and interaction of infinite and infinitely complex motives. This indeed, in a meagre and far cruder form, is essentially the popular view ; the sort of history upon which most people are still brought up divides men, actions, and institutions into good and bad according to the writer's present notions of what might and ought to be, and distributes blessing and cursing without more



ado. Only Clifford, accepting to some extent the popular or pictorial way of looking at history, took on most questions the unpopular side, and so found himself in collision with current opinions. He had a fair general knowledge of English literature (by which I mean considerably more than is yet supposed necessary for an Englishman's education), with a preference for modern poetry, and especially for such as gave expression to his own ideas. Milton's prose had also a special attraction for him. I do not think he cared much for the use of language as a fine art, though he had a great appreciation of arrangement and composition. His own style, always admirably clear and often eloquent, was never elaborate; for we cannot fairly count the studied ornament of his College declamations, which were not only produced while he was an undergraduate, but for an occasion which justified some special aiming at rhetorical effect. Much of his best work was actually spoken before it was written. He gave most of his public lectures with no visible preparation beyond very short notes, and the outline seemed to be filled in without effort or hesitation. Afterwards he would revise the lecture from a shorthand-writer's report, or sometimes write down from memory almost exactly what he had said. It fell out now and then, however, that neither of these things was done; and in such cases there is now no record of the lecture at all. Once or twice he tried writing part of the lecture beforehand, but found it only an embarrassment in the delivery. I believe the only one wholly put in writing in the first instance was *Ethics of Religion*, which he

was unable to deliver himself. I cannot find anything showing early aptitude for acquiring languages; but that he had it and was fond of exercising it in later life is certain. One practical reason for it was the desire of being able to read mathematical papers in foreign journals; but this would not account for his taking up Spanish, of which he acquired a competent knowledge in the course of a tour to the Pyrenees. When he was at Algiers in 1876 he began Arabic, and made progress enough to follow in a general way a course of lessons given in that language. He read modern Greek fluently, and at one time he was curious about Sanskrit. He even spent some time on hieroglyphics. A new language is a riddle before it is conquered, a power in the hand afterwards: to Clifford every riddle was a challenge, and every chance of new power a divine opportunity to be seized. Hence he was likewise interested in the various modes of conveying and expressing language invented for special purposes, such as the Morse alphabet and shorthand. One of his ideas about education was that children might learn these things at an early age, perhaps in play, so as to grow up no less familiar with them than with common printing and writing. I have forgotten to mention his command of French and German, the former of which he knew very well, and the latter quite sufficiently; I think his German reading was mostly in the direction of philosophy and mathematics.

In 1863 Clifford came up with a minor scholarship to Trinity College, Cambridge; in his third year (to continue for the present on the line of his literary accomplish-



ments) he won the College declamation prize¹ with a very brilliant discourse on Sir W. Raleigh, partly cast in the form of quasi-dramatic dialogues, and accordingly had to deliver the annual oration at the Commemoration of Benefactors in December. His subject was a panegyric of the late Master of the College, Dr. Whewell, whose death was then recent. It was treated in an original and unexpected manner, Dr. Whewell's claim to admiration and emulation being put on the ground of his intellectual life exemplifying in an eminent degree the active and creating faculty. 'Thought is powerless except it make something outside of itself: the thought which conquers the world is not contemplative but active. And it is this that I am asking you to worship to-day.' Taking this oration as a whole, it must be considered as a *tour de force*, giving glimpses and undetermined promises of speculative power. But there occurred in it an apologue which caught the attention of some good judges at the time, and so well illustrates the fanciful and sportive side of Clifford's mind that I shall here transcribe it.

'Once upon a time—much longer than six thousand years ago—the Trilobites were the only people that had eyes; and they were only just beginning to have them, and some even of the Trilobites had as yet no signs of coming sight. So that the utmost they could know was that they were living in darkness, and that perhaps there was such a thing as light. But at last one of them got so far advanced that when he happened to

¹ He was bracketed with Mr. C. A. Elliott for the first prize: but (I now forget for what reason) the office of delivering the Oration fell to Clifford alone.

come to the top of the water in the daytime he saw the sun. So he went down and told the others that in general the world was light, but there was one great light which caused it all. Then they killed him for disturbing the commonwealth; but they considered it impious to doubt that in general the world was light, and that there was one great light which caused it all. And they had great disputes about the manner in which they had come to know this. Afterwards another of them got so far advanced that when he happened to come to the top of the water in the night-time he saw the stars. So he went down and told the others that in general the world was dark, but that nevertheless there was a great number of little lights in it. Then they killed him for maintaining false doctrines: but from that time there was a division amongst them, and all the Trilobites were split into two parties, some maintaining one thing and some the other, until such time as so many of them had learned to see that there could be no doubt about the matter.'

The interpretation was barely indicated on this occasion; but it is worked out in another Cambridge MS. which must have been written shortly afterwards, and in which the apologue stands first as a kind of text. It was nothing less than a theory of the intellectual growth of mankind; and the position was that, as the physical senses have been gradually developed out of confused and uncertain impressions, so a set of intellectual senses or *insights* are still in course of development, the operation of which may ultimately be expected to be as certain and immediate as our ordinary sense-perceptions.



This theory may be traced in the discourse 'On some of the Conditions of Mental Development,' delivered in March, 1868, which stands first in the present collection; and for that reason I make special mention of it. Otherwise it was only one inventive experiment among many. I should far exceed my limits if I were to attempt any account of the various forms of speculation, physical, metaphysical, social, and ethical, through which Clifford ranged in the first few years after his degree. Not that he was constantly changing his opinions, as a superficial observer might have thought; he was seeking for definite principles, and of set purpose made his search various and wide-spread. He had a singular power of taking up any theory that seemed to him at all worth investigating, realizing it, working it out, and making it completely his own for the time being, and yet all the while consciously holding it as an experiment, and being perfectly ready to give it up when found wanting.

Clifford's mathematical course at Cambridge was a struggle between the exigencies of the Tripos and his native bent for independent reading and research going far beyond the subjects of the examination; and the Tripos had very much the worst of it. If there was any faculty in which he was entirely wanting, it was the examination-faculty. On this subject I am not competent to speak with certainty, but it is my belief that, from the point of view to which the class-list is an end in itself, Clifford omitted most of the things he ought to have read, and read everything he ought not to have read. Nevertheless his powers of original work carried him so far that he came out Second Wrangler in the

Tripos of 1867, and was also Second Smith's Prizeman. I am fortunately able to quote on this head the statement of one of our first living analysts, Professor Sylvester:—

'Like the late Dr. Whewell, Professor Clerk Maxwell, and Sir William Thomson, Mr. Clifford was Second Wrangler at the University of Cambridge. I believe there is little doubt that he might easily have been first of his year had he chosen to devote himself exclusively to the University curriculum instead of pursuing his studies, while still an undergraduate, in a more extended field, and with a view rather to self-culture than to the acquisition of immediate honour or emolument.'

This pursuit of knowledge for its own sake, and without even such regard to collateral interests as most people would think a matter of common prudence, was the leading character of Clifford's work throughout his life. The discovery of truth was for him an end in itself, and the proclamation of it, or of whatever seemed to lead to it, a duty of primary and paramount obligation. This had something to do with the fascination of his teaching; he never seemed to be imposing dogmas on his hearers, but to be leading them into the enjoyment of a common possession. He did not tell them that knowledge was priceless and truth beautiful; he made them feel it. He gave them not formulas, but ideas. Again I can appeal to a witness of undoubted authority. The following words were written in 1871 by a man in no way given to unmeasured expression of his mind, and as eminent in mathematical physics as the author of the statement I have already cited is in pure mathematics, I mean Professor Clerk Maxwell:—