

CHAPTER IV

MY EARLY DAYS AND PURSUITS

THE events which first awaken memory are not necessarily the same as those which first call forth any of the higher exercises of mind. Of course, the mere memory of an event is in itself the memory of some thought about it. But that thought may be unconnected with any other. I have often tried to recollect what it was that first awoke in me anything like reflection. It is a mistake to suppose that a life led wholly in a remote country home could have been a life secluded from the great thought movements of our time. The tides rise and fall as freely at the farthest ends of a long arm of the sea as at the gateways through which the ocean finds admittance among the hills.

The four years after my mother's death were years of great events. In 1829 there came the settlement of a long contest in the concession of Catholic Emancipation. In 1831 came the visitation of the Asiatic cholera in Britain. In 1830-1832 there followed a desperate struggle for the reform of Parliament. My father had been too long a member of the House of Commons not to take at least such part as could alone remain to a mere country gentleman in these great events. And yet, as regards what was called the Catholic Question, I remember nothing more than an echo that must be largely mingled with the sounds of somewhat later years. He had followed the politics of his family—which I need not say were Whig. The very word Whig is said to have been originally derived from some local name connected with one of the Covenanted

military associations of my ancestor, the Marquis of Argyll.

For a long time Whig politics were essentially antagonistic to the Roman Catholic cause—for the natural and sufficient reason that for centuries the Roman Catholic Church had been hostile to the liberties of the British people. But with the final settlement of the Protestant succession, and the failure of the two Jacobite Rebellions of 1715 and 1745, this association of ideas slowly and gradually disappeared—how slowly and how gradually is well seen in the persistent resistance of George III. to the views of his favourite Minister, Mr. Pitt. That resistance rested on the traditional policy which was identified with the establishment of his family on the throne, and with the literal meaning of the Coronation Oath. But security had brought confidence, and the undoubted good conduct of the Catholics as a body in the dangers which arose out of the French Revolution, as well as the felt necessity of conciliating, if we hoped to rule, the great bulk of the people of Ireland, had wrought a complete change, and had converted a change of policy into a necessity of State. All that I recollect my father saying was that he had voted with his party for many years in favour of the Catholic claims; but he was shocked when the Duke of Wellington confessed that he was afraid of Ireland, and based his change of policy mainly on that ground. To that argument my father would not bow, and always said that he would not have voted as he had before done. This recollection convinces me that my father had not a political mind, in which I am farther confirmed by the fact that, although he was for many years in the House of Commons during the ministry of Mr. Pitt, which lasted from 1784 to 1801, and although he must have heard many of the great oratorical encounters between that master of speech and his rival, Mr. Fox, I never heard him refer to any one of them in his conversation. The only leader of whom I ever heard him speak with any

admiration was the Duke of Wellington, and that in his character as a soldier rather than as a Minister.

The Reform Agitation, which immediately succeeded Catholic Emancipation in 1829, has left far more distinct recollections in my mind. It is now much forgotten how violent and universal the excitement was. But it was specially violent in Scotland. This arose from the circumstance that the previous condition of things had come to be far more obviously absurd in Scotland than in England. The number of men entitled to vote for members of Parliament had come to be the merest fraction of the people, and this fraction belonged exclusively to one class. When the public mind came at last to be fixed upon the subject, the condition of things was too glaringly at variance with any possible theory of Parliamentary representation to stand discussion for a moment. So, at least, we think now. And yet, as a matter of fact, it had stood discussion for no less than half a century, not only without any general recognition of any necessity for a change, but with a general acquiescence in the arguments by which it was deprecated and resisted.

The dread and horror inspired by the madness and the wickedness of the French Revolution had, no doubt, much to do with that resistance, as it was the main influence on the mind of Mr. Pitt, who had been one of the earliest reformers. But we shall do little justice to the attitude of those who resisted the change to the very last, unless we recognise the truth of many of the arguments used by the opponents of reform. The doctrine of 'virtual representation,' which played a great part in their reasoning, was, within limits, perfectly true. It is quite possible, under special conditions of society, for a very few actual electors to be, on the whole, fair representatives of almost any number in a possible constituency. The Parliaments of the United Kingdom had been always on at least a full level of intelligence with the great body of the people. They had fully represented the aggregate opinion of the

country, both during the great contest with Napoleon and since its close. Nor was there any new measure or system of domestic policy, clearly desired by the people, the denial of which would be a source of anger, or even of agitation. It is more than doubtful whether the public generally, either in Scotland or in England, if popularly represented, would have granted Catholic Emancipation. It is much more probable that this act of true wisdom would have been violently resisted by the ultra-Protestant feeling of the masses. Nor was the old Parliament open to the charge of standing in the way of those other measures which, at a later date, came to be identified with the interests of the people.

Most of us have now come to the conclusion that the old Corn Laws had been a mistake, and that restrictions in the import of food were an impediment to trade and to a rise in the value of labour. But the mobs who shouted for reform of Parliament in 1831-32 had no idea of this, because the theory of Protection was then the theory of all classes, and especially of those who were concerned in manufacture and commerce. Accordingly, as a matter of fact, it was thirteen or fourteen years after the passing of the Reform Bill that the new Parliament began seriously to adopt the policy of Free Trade. Even then it was driven to the adoption of it by the unprecedented calamity of the great Irish famine of 1846-47. It is a mistake, therefore, to suppose that opposition to a great change in the constitution of Parliament was an error which convicts all those who joined in it of all that purblindness and political stupidity which we are apt now to attribute to it. This is one of the many cases in political affairs in which all sense of true perspective has been lost in the foreshortenings of history, and in the sharp turnings taken by events rapidly accomplished, and by doctrines suddenly, yet universally, accepted. It is still vulgarly believed by many that the resistance to reform came mainly from the House of Lords, whereas the fact is

that the resistance of the House of Commons lasted during fifty, whilst the resistance of the Lords lasted barely for two, years.

When a man of the genius, imagination, and liberal disposition of George Canning was one of the sturdiest opponents of the Reform Movement, we may be quite sure of at least the reality of some of the dangers which beset it, and of the possibility of a rational opposition. My father was strongly opposed to it—an opposition which I think was largely founded on that fear of Jacobinism which had been so powerful an element in the hand of Pitt, and had been to some extent renewed in much later years by symptoms of popular disaffection, and even of contemplated insurrection in certain parts of Scotland in 1821. I can still recollect his speaking of drillings by night, and of the discovery of hidden pikes, which must have reminded him of the sad work he had to do in Ireland in 1798. The result, though certainly not a logical result, of all these facts and associations made him an eager opponent of the administration of Earl Grey—a man whom he remembered for years in the House of Commons as one of the determined enemies of Mr. Pitt, and of whom he used to tell the story, which I have been unable to verify, that he was the only member of the House of Commons who ostentatiously wore coloured clothes, when all others came down in mourning, on the murder of Louis XVIII. being announced from Paris. My father had erected a high flagstaff on the top of a new tower which had been built in connection with an addition to the castle. On this flagstaff he used always to hoist a large Union Jack whenever Lord Grey's Government received any check, so that very often the country people round, who saw the well-known flag before they knew the cause, used to say, 'Hech, sirs! what's come over the Whigs noo?'

When the riots and the incendiarisms at Bristol and elsewhere took place, little local echoes of the same spirit reached even the quiet shores of the Gareloch,

and I recollect hearing the shouts of such a mob as the village of Helensburgh could then afford, coming along the road between the castle and the sea. No doubt my father's somewhat provocative defiance of the popular side in his flaring flag hoisted on all occasions might, if near great popular centres, have brought down on him dangerous attacks. In one of the elections held during those years, the mob in the burgh of Dumbarton, nine miles off, had exhibited a very ferocious temper. The Tory candidate, Lord William Graham, one of the Montrose family, had to seek refuge for his life in a house in the town, where he was surrounded by a besieging mob. He was only delivered by my old friend and host, Lorne Campbell, who, though acting on the Whig side, rallied a body of ship-carpenters from the building-yards on the Leven, rescued Lord William, and took him to a place of safety. One day is vividly impressed on my memory, when either from threatening letters or some other source of information my father anticipated a possible attack on his house. This he was determined to meet, if it came, by an armed resistance. He had many guns of various kinds in his possession. With these he armed all available men-servants, the tutor of his boys, and himself. The spirit of his brave mother, when she refused to obey the mob whose idol was a disreputable scoundrel, was the spirit of her son, when the right of any man to express his political opinions freely was openly threatened by howling mobs. Fortunately, no attack was made; for I am sure that in self-defence he would not have hesitated to open fire on those who had first recourse to violence.

But, although these memories of the Reform Agitation are vivid in my mind, they stand there absolutely isolated and alone; they have no organic connection with the history of my life or with the development of my mind. Neither then, nor for a good many later years, had I awoke to political feelings of any sort or kind. It is true that the atmosphere of opinion in

which we live as children may have an unconscious effect of which no trace is left in memory. But in my case that atmosphere was on the whole essentially non-political, and when the tempestuous squalls of a temporary excitement had passed away, the air I breathed was one of altogether peaceful interests and pursuits. My father was so busy with his plantations, with his turning-lathes, with his sawmill, and with such scientific reading as the *Mechanic's Magazine*, that I do not recollect his ever speaking on politics at all. Nor is this surprising, for it is to be remembered that the Reform Act of 1832 was absolutely successful in allaying the almost revolutionary agitation which alone had carried it. The delusive fears, and the not less delusive expectations, it had roused were alike submerged under those deeper-seated currents of our political system, which immediately resumed their sway, and under which, within the short space of nine years, so great a reaction was brought about that the Conservative party, which had seemed to be completely overborne, returned to power in 1841 with a majority of ninety-one. During all those years of slow but steady reaction there was nothing to arouse my father's political feelings, though he watched with interest the gallant and skilful tactics with which Sir Robert Peel dogged the faltering steps and the declining credit of the Whig Ministries which succeeded that of Lord Grey. I recollect, indeed, his amusement and delight when in 1834 all the offices of the State were temporarily held by the Duke of Wellington, pending the return of Sir Robert Peel from Italy. But this, too, was a passing incident, and it hardly sufficed to change even for a moment the placid tenor of my boyish life, or to call away my thoughts from the very different subjects with which they were habitually engaged.

It would be very difficult for me now to define even to myself in any form of words what those subjects were: they were so merely boyish in their beginnings,

so far-reaching and so various in the issues to which they led. Natural history in all its branches, but in particular ornithology, was the substratum of the whole. My father had given me a small hand telescope. With this it was my special delight to identify every bird with its peculiar song, securing for this purpose by the glass an artificial nearness which is often much needed with the shy warblers. In this way I became familiar with the notes of all the species which were common, and of some that were, and are, comparatively rare. In this way, also, I was able to watch the habits of birds at a distance, when they could not know that they were seen, and when, therefore, their natural manners were undisturbed. Moreover, at a very early age, how early I cannot quite remember, I began to write careful notes of every day's observations on my favourite pursuit. This journal I kept quite secret, never showing it even to my brother. The bird fauna of my father's estate was not a very large one; and the absence of many species of which I read in Bewick and other books was a standing trouble to me, but also a standing incitement to closer watching in the woods and fields. One case of absence gave me special trouble. It was that of the marsh tit, since the whole tribe of titmice were my greatest favourites, and all were abundant except the crested tit, which I could not expect to see, and the marsh tit, which I knew to be abundant in England. For a long time I suspected that it must be escaping my observation owing to its general resemblance to the cole tit, both species having a black head, but the cole being distinguished by a white space running up from the nape of the neck to nearly the top of the head. Frequently I was rejoicing in seeing some little black head which looked like the marsh tit, and my telescope was fixed on every movement of the bird, so as to identify the species. But, alas! always when the nape of the neck became visible, the obnoxious white stripe of the cole destroyed my hopes. My eager watching, how-

ever, for this absent species had one good effect, in leading me to appreciate better the extraordinary charm of the cole tit. With the exception of the gold-crest, it is the smallest of British birds, as it is also the most active and alert. Never for an instant still, it more often feeds on the ground than any other of the titmice, hopping eagerly and lightly over the fallen leaves in winter, digging under them, tossing them aside in search of buried treasures of insect life, or of beech-mast and other seeds. When any prize is found, the cole instantly darts up to the nearest bough, and there, holding it down by one claw, hammers it with the bill till all edible contents are extracted and devoured. This done, the mercurial little bird darts down again to the ground, and resumes its rapid and eager flittings over the mosses and the leaves. And during all the manoeuvres the head and neck are in perpetual movement, turning and stretching from side to side, with an eager and impatient curiosity, but always in attitudes expressive of the most charming archness and full of the most perfect grace.

It was in connection with this constant quest for missing birds that I had my first experience of those curious coincidences between certain vivid impressions of the mind and corresponding outward occurrences, which few people pass through life without encountering occasionally, and which always strike them as mysterious, suggesting as they do some channels of connection between the internal and the external world which in their nature are unrecognised and unknown. There was one bird, represented in the books as not uncommon, which, from a coloured plate, seemed to me the most beautiful of British birds, but which I had never seen. This was the redstart. It is a species which is widely distributed in the British Isles, but is nowhere abundant. I have since seen it on the wild but sheltered shores of Loch Torridon on the north-west coast of Ross-shire, and more abundantly than elsewhere among the fine old

trees of Richmond Park. But in my boyhood I had never seen it among the woods of my home, till on a certain day I was sitting at my desk in the schoolroom working at the Latin grammar, or some other horror of the like kind, when suddenly the name and idea of the redstart was flashed upon me as somewhere near at hand, and, on looking out of the window near which I was sitting, there was the bird perched on the apex of a conical stone belonging to the old castle, which had been taken down during some alterations, and had been placed as an ornament on the gravel walk in front of the house. My delight and astonishment were unbounded. The recognition was instantaneous and conclusive—for, indeed, there is no other bird with such an assemblage of peculiar characters. The pure white brow upon a head otherwise very dark, the pale red breast, the fiery tail with its very singular vibratory motion—all these are unique among the tribe of the warblers. It must be about sixty-five years since this circumstance occurred, and the pleasure it gave me is vivid still.

But my greatest amusement among birds was derived from an immense rookery which I looked upon as the glory of Ardencaple. The whole of a long and broad wood through which the approach ran for about a quarter of a mile was thickly peopled by those curious and entertaining members of society. The trees which had been planted at the foot of the steep bank on which the castle stood were all covered with the nests, and, as the roots of those trees were some 30 feet below the foundations, their top branches were no higher than the upper windows, some of which were almost touched by the boughs and birds. The nests were therefore largely on a level with the windows, and accessible to continuous observation. There was one window on the upper story of the house which was circular in form, with a sill which sloped inwards. On this sloping surface I contrived to perch myself, whilst, with a book in hand, I used to watch all the habits of

the 'crows,' as rooks are always called in Scotland. Many of these habits are very curious and interesting. Many of them have been well described. But two things specially attracted my attention: one was the great distance off at which the hen birds, when sitting on their eggs, could recognise their mates coming with food, although these mates were flying among a crowd of other husbands, all coming on the like errand to other expectant wives. The walk of a man is sometimes so distinctive as to be easily recognisable at a considerable distance. But I question whether it is ever so distinctive as to enable a human friend to recognise his nearest at a distance comparable with that at which a sitting crow can instantly recognise the flight of her coming mate. It impressed me with the distinctions which our blind eyes are incapable of seeing; and this is a thought which has wide and instructive applications in many other spheres of knowledge and observation.

But there was another conviction pressed home upon my mind by watching my friends the crows, and that was a conviction which relates to much higher qualities in those birds. I felt certain from what I saw that in cases where one parent had been shot on some farmer's field, and the young were left at least half orphaned in their nest, some neighbouring parent helped the widowed mother in the feeding of her young. This conviction arose from often seeing one crow feeding the young in other nests besides his own, a fact for which it is impossible to account by any other explanation. We have here a very high development of the social instinct—not higher, however, than in some acts of creatures much lower in the scale of being than birds, such as ants and bees. But instinct rises in its quality with the comparative elevation of the organism with which it is associated; and the near approach to moral qualities which is represented in one crow feeding the orphaned young of another implies a far higher nature than is represented in the act of an ant taking charge

of derelict eggs or pupa which have been scattered from its native ant-hill.

The educating effect of the physical sciences, and of natural history, considered as one of them, depends entirely on the conditions under which they are pursued. It is quite possible to finger the facts of Nature without even a passing thought of any of the wonderful problems they involve. On the other hand, there is no door into those facts, however small, which does not lead by endless passages into the deepest questions of philosophy and religion. Tennyson's few lines concerning one of the most familiar plants that nestle in old walls are literally true :

‘ Little flower that grows upon the wall,
I pluck you out of the crannies ;
Could I know what you are all in all,
I should know what God and man is.’

Any complete separation between the disposition to enjoy Nature and at least some desire to understand her may be a temporary mood, as Wordsworth has expressed it :

‘ Contented if I might enjoy
What others understand.’

But this cannot be a permanent attitude of the mind. The relations between all natural phenomena and corresponding affections of the human spirit are too many and too near to allow of this divorce. If the tendencies of my own mind had been such as to favour a mere passive enjoyment of things beautiful and curious in Nature, I should have been saved from such an intellectual sleep by my father's favourite pursuits and his frequent conversation. It so happened that, years before I was born, he had been attracted from human mechanics to the great subject of animal mechanics in the structures of organic life, and especially to that most wonderful example which

is presented in the flight of birds. He had grappled with the difficult and complicated problems it presents in every point of view, testing his theories by experiments, by calculations, and by machines of most ingenious construction. He always saw that the true explanation of the phenomena of flight had been correctly given by an old writer, Borelli, in his work 'De Motu Animalium,' and that all late attempts to navigate the air had been founded on complete ignorance of the fundamental mechanical laws which must be recognised and obeyed.

The field of animal mechanics is one of enormous breadth, and in every corner of it we meet with organic structures which are examples of the most complicated mechanism for the doing of some special work which could not be done without it. In so far as this general principle of explanation is concerned, there is no difference whatever between the wing of a bird and the hand of a man. But there are some special circumstances affecting the machinery of flight which do not belong to the machinery of prehension or of walking; and these special circumstances make the phenomena of flight more striking, and in some respects more instructive, than those of any other function among living things. One special circumstance is what may be called the externality, and consequent visibility, of the tools which are employed. If our own structures were as naked and visible to the eye, if our outside coverings were as diaphanous as they are in some of the lower creatures, we should be in perpetual astonishment at the infinite complexity of the purely mechanical apparatuses of which our vital tissues are composed. These indeed are to a large extent the same as in birds. The bones of birds, and the muscles which move them, are constructed on exactly the same principle as our own, although with special modifications as to shape, concentration, and relative position, which are all in harmony with the object to be attained. But neither the wing-muscles nor

the wing-bones would of themselves enable a bird to fly.

During the years in which my father was studying this problem of the flight of birds, the great Cuvier was carrying on those profound researches which raised up, on broad and deep foundations, the splendid science of comparative anatomy. It was comparative not only as between living animals, but as between them and animals long extinct. It was at a later date that Owen, Cuvier's pupil and successor in England, built upon the same basis those conclusions as to the unity of plan in the skeleton of all vertebrates which were popularized in his work, 'On the Nature of Limbs.' Of all this order of ideas my father knew nothing. I never heard him even allude to the wing-bones of birds, or indicate an idea that they were fundamentally the same as the bones of his own forearm. All these conceptions came later than his day, and they would have been a destruction rather than a help to him in his special work of explaining the mechanics of flight in birds, as distinguished from all other methods of animal progression.

In all quadrupeds, in man, and in birds, too, so far as regards their feet, the mere anatomical structure of their limbs—their bones, muscles, and sinews—are all-sufficient in themselves, when fully developed, to enable the animal to support its own weight, and to stand or leap or run on the solid ground. They need no adjuncts of an external kind. But this does not apply to the fore-limbs of birds. In their own anatomical structure they are incapable of giving the power of flight. In the thin and invisible medium of the air, they are in themselves merely parts that add to the weight of the whole, and thus add also to the difficulty of overcoming the force of gravity. Unless furnished, therefore, with some—in a sense—artificial and external adjunct, that great difficulty could not possibly be overcome. This was the point on which my father always fixed his attention, and he was never tired of

dwelling on the truly wonderful device, first, in each separate wing-feather as regarded its own properties and structure, and, secondly, in the combination of the series of them in one special arrangement for the production of a very special and a most difficult mechanical result. The great complexity both of the separate units and of their combined arrangement was always pointed out as a necessity for making successful use of the elastic properties of the air. If heavy bodies were to be made capable of navigating the thin and yielding atmosphere, and of exercising in it the most easy and beautiful evolutions, a very peculiar machinery had to be provided for the purpose. It could only be done by knowing how to do it, and this was the knowledge which we must make our own if we were to understand the machinery of flight. We might or we might not be able to imitate it, but we could certainly understand it. It was not effected in Nature by any miracle, but by the use of certain appropriate means, which are as purely mechanical as in the case of any other apparatus.

It was in the light of this idea that my life as a boy was spent in continual observation and in continual reasoning on what I saw. It never was to me in the least degree a theory or an abstract conception. It was a simple matter of obvious fact. My father never concerned himself with what is ordinarily called philosophy, or with any arguments on natural theology. His mind was eminently practical, and his explanations of the mechanics of flight were founded on the same fundamental principles on which he would explain the action of the then newly-invented paddles in steam navigation. With this principle in full and unquestioned possession of my mind, I was continually testing by observation the explanation he gave of the power of a bird's wing. And my observation confirmed it. When a crow was seen on a level with my eye flying either to or from me, I used to note the bending up of

the wing-feather tips, answering exactly to the function he assigned to those quills—the double function, namely, of at once sustaining and propelling the body to which they were attached. The simplicity and beauty of this contrivance was deeply impressed upon my mind, and the general ignorance of it even in our own day, despite all our advances in practical mechanics, is a standing astonishment to me. But the whole subject becomes clear, if one is once in full possession of this principle of interpretation, namely, the principle that the function or duty which every part of an animal was destined to discharge must always be the antecedent explanation of its structure, whilst, conversely, that structure must be governed by the necessity of conforming to certain fixed conditions if it was to be competent for its work.

In handling and skinning dead birds I soon came across variations in the structure of feathers, which proved their subservient adaptability to kinds of work which are not only various, but opposite and contradictory. One essential quality of the wing-feathers is their imperviousness to the passage of air through the quill-vanes. If these were pervious to the air they would be useless for the purposes of flight, because that purpose absolutely demands that aerial resistance to the wing-stroke should be economized to the very uttermost. But as the whole body of a bird is equally clothed with feathers, it becomes a question whether this characteristic is equally suitable for the needs of other parts of the body. Would the texture of wing-feathers do well, for example, for its underclothing—for the keeping out of cold, for the non-conduction and consequent saving of the animal heat? Clearly not. I was struck, therefore, by the fact that, where those purposes have to be served, the structure of feathers is so modified that, always recognisable as consisting of the same elements, they are absolutely different in their function and effects. The down of an eider-duck, although a finer article than

the down of other birds, is essentially of the same structure as theirs, whilst the wing-feathers of all are equally different in essential properties. But there was another illustration of the same general law which struck me even more. How could feathers impervious to the passage of air be adapted to the covering of the ear in birds, seeing that the ear is an organ depending for its functions entirely on the free access of those fine aerial pulsations which we know as sound? I was struck by discovering how this problem was solved. Just as the texture of wing-feathers would have been useless for warmth, just as the warm texture of down would have been equally useless for affording free access to sound, so a third modification of structure had to be provided for feathers covering the ear. Accordingly, I found that modification provided in a patch of feathers on the cheeks of all birds round the opening of the ears, which by a beautiful and special adaptation is perfectly fitted for the purpose. In all respects they are true feathers, and not mere hairs. They have the same root and stems of quill. They have the same attached filaments. But these filaments, instead of being hooked together so as to form a continuous web, are, on the contrary, separated by empty spaces, and are thus rendered completely discontinuous. Thus, the air passes completely through them, with the result that sound is not impeded, and the hearing of birds is singularly acute.

There was, again, another case of special adaptation in the feathers of birds, which to my mind was almost more striking than any other. The blow of a bird's wing upon the air in flying must be powerful to produce the requisite resistance. But such blows cannot be delivered without the production of noise. In some birds, such as swans, the noise is very loud indeed, audible at a great distance. Even in the common wood-pigeon the swishing noise of their wings may often be heard when they are at a great height. In all ordinary cases this production of noise is no injury to birds. Those

that are the prey of others are never detected except by sight, and noiselessness in movement would be no protection. But there is one class of birds to which a noisy flight would be so injurious as to be incompatible with the getting of their food. These are the owls, which prey upon the small nocturnal mammalia, such as mice, or on larger creatures, such as rabbits and hares. What owls therefore require, above all things, is a soft and noiseless flight. And yet their wing-feathers must be not less continuous and strong than those of other birds. Accordingly, again, the absolute need is met and provided for by another purely mechanical device—analogous to that of muffled oars for the silent rowing of boats upon the water. The whole wing-feathers of owls are fitted out with loose downy filaments, which quench sound by causing the escaping air, after it has done its work, to pass through a downy and soft material.

There was another department of natural history with which I was early brought face to face in Nature, and through which I drank in the indelible impression of her inexhaustible mechanical ingenuities. There were then none of those charming aquarium tanks which have since become so common. In stooping down to drink out of the most crystal streams, or in chasing water-beetles on stiller ditches, I had often seen mere bits of sand suddenly appear to put out legs and move, or bits of mud as suddenly reveal themselves to be living creatures.

We took a capacious tub for our aquarium, and soon gathered together a goodly collection of everything we could catch alive. Their structures were various and wonderful, but we could always see their purpose. If sometimes we wondered how a caddis worm could glue to its own sides bits of rotten stick and bark, we always saw in a moment the reason why. By means of this power they often deceived ourselves, and by means of it they could obviously deceive even the most watchful trout. How sometimes they could

encase themselves wholly in the loveliest and most transparent grains of sand, selecting these from all coarser material, was a perpetual wonder to us. But the reason why they should do so, if they could, was a direct and intuitive perception. The concealment was so perfect as to defy detection. Then the various apparatuses for different kinds of movement in and under water, for rowing, for punting, for rapid burrowing, for running, even, and leaping on the surface—all these were impressed upon me by watching the life and doings of aquatic larvæ.

Above all I was impressed by what is now called the metamorphosis of these creatures. The hatching of birds from eggs had attracted my father's careful attention before I was born. He had investigated it systematically. Like a cuckoo, he had introduced an egg of his own making under sitting hens—a metallic egg with a small thermometer put inside. This egg he could rapidly open and read off the hatching temperature. Applying this knowledge, he had hatched multitudes of chickens by artificial heat, and I was familiar with the facts. But my father told me nothing of that second hatching by which the most hideous aquatic larvæ, after leading an independent life in water, are rapidly transmuted into gorgeous winged creatures, living in a new element, and having no recognisable likeness to their former selves, either in form, or in structure, or in habits. I had often wondered silently how so short a time as twenty-one days could be enough to transform the yolk and white of an egg into a completed chicken, with even its wing-feathers so perfect in form as to be ready for at least a fluttering flight. But this seemed nothing to the wonder of a hideous aquatic worm being transformed into a terrestrial fly in the course of a few hours. I never heard any argument relative to the subject, nor did I ever think of one. I never heard anybody argue or assume that long ages of time could alone produce great changes in living things. But in later years,

when such reasonings reached my ears, my mind was too full of the presence and the power of well-remembered facts to allow of such a conception finding entrance.

The educating effect of these pursuits was to me enormous. The mere collecting of stuffed birds, or even the study of the classification of species and genera, could never be of equal value. I had few books of any use for such purposes. Sixty years ago the literature of natural history was poor and scanty. Bewick, of course, was constantly in my hand, but he is only valuable for his incomparable woodcuts. White's 'Natural History of Selborne' was indeed a more enduring resource—as it has been throughout my life, especially during illness. But the charm of Gilbert White lies in its simple and calm reflection of the woods and fields. He has no recondite reflections on Nature. The profounder questions more recently raised by the expanding science of biology lay deep under the surface of his letters, as they do under the more familiar aspects of external things. In such of these profounder suggestions as arose out of my father's teaching I had no other book than the Book of Nature. I valued all other books in proportion as they explored with truth her inexhaustible facts and aspects. I can never forget the delight with which I recognised one day in the woods of Ardencaple, solely by the graphic description of Gilbert White, the song of the largest of the willow-wrens discovered by him, since called the wood-wren (*Sylvia trochilus*).

The evoking of our mental powers, and the supplying of them with the ordinary elements of instruction, are two very different kinds of work. My education in the latter sense of the word was entirely conducted by private tutors. All of these were young men prepared, or preparing themselves, for the ministry of the Established Church of Scotland. They were all most worthy men, but only two of them attained to even

local eminence in their own religious body, and not one of them ever exercised upon me any influence which I can now trace. None of them cared for my pursuits, and I never spoke to them on the subject. None of them were enthusiasts in anything which they did teach, and without enthusiasm in teaching there can be no influence on the taught. I never was brought to care for the classical languages, or—with one exception—for any of the authors whose writings I was compelled to read. That one exception was Virgil. I enjoyed the beauty of his verse, and the frequent images he drew from Nature. There was one passage in particular which gave so perfect a picture of the flight of birds that it seemed to me as if the genius of the poet must have almost penetrated, by a kind of inspiration, the secret to which I had acquired the clue from my father's teaching. It is the passage in which the first rush of triremes in starting from a harbour is compared to the first flight of startled doves from their favourite shelter in rocky caves. The vehement agitation of their wings is described in beautiful contrast with the ease, confidence, and tranquillity of the later course when once well under way. It is a passage which exhibits in perfection that complete harmony between the sound of words and the pictures they are intended to recall which is one of the highest perfections of poetic form. The first and the last lines, even when pronounced in the barbarous English fashion, still more when pronounced in the Continental and Scottish fashion, are perfect examples of the assonance of sound and sense:

‘Qualis spelunca subito commota columba

* * * * *

Radit iter liquidum, celeres neque commovet alas.’

But though I am afraid I was idle and listless in the schoolroom, I was full of activity outside of it. I was an omnivorous reader. My father had a tolerably large library, very miscellaneous in its character.

Yet it was almost entirely deficient in poetry and in fiction. I read with pleasure those standard works of Hume and Robertson whose classic style first inspired the young ambition of Edward Gibbon. The shelves were rich in voyages, and I devoured with intense interest the narratives of Parry and of Scoresby, as well as of Dampier and of Cook. Of tales about the French Revolution I was never tired, and I drank in from them that horror and hatred of unrestrained humanity, when let loose from the bonds of authority and of law, which I have ever since retained. All such books were natural to the taste of boys. But there were some which exercised over me a great attraction, respecting which I have often wondered since both as to the cause and the effect. Amongst these were the famous 'Letters of Junius.' Whether the mystery of their origin was to me a great attraction, as it undoubtedly was at the time they appeared, I find it difficult to say. But of one thing I am sure, that my pleasure in reading them was not founded on, or accounted for, by any equivalent knowledge of the political transactions or of the political personages which were the subject of those famous compositions. So far as I can now judge, I was captivated entirely by the vigour of the writing—by the incisiveness of the style, by the strength, and the apparent virtuousness of the indignation they expressed.

Amid all these miscellaneous interests, there was one to which I must refer because I am sure it had a special effect upon me. My father's interest in mechanics was not purely scientific or theoretical. He was himself a highly-skilled artisan. Besides ordinary turning-lathes which abode in a workshop at the top of the house, he had brought with him to Ardencaple one of the finest of those beautiful machines made by the firm of Holtzapfel in London which were called Rose Lathes. I am told they are now unknown. It was the only ornamental piece of furniture in the library; its elaborate apparatus of polished steel and

its 'barrels' of richly-burnished brass were the delight and wonder of my boyish eyes. With it my father used to make many beautiful objects of rare woods and of ivory, and of those lovely materials in combinations which were highly ornamental. There is one tropical nut in particular, about the size and shape of an ordinary hen's egg, out of which he made pocket drinking-cups with rims of ivory, and these all his friends were glad to get as valuable presents. The kernel or seed of the nut occupied a very small cavity in the centre, and was surrounded by a great thickness of dense, hard, ligneous material, which was susceptible of the highest polish. The colour was of rich yellow brown, and when the cavity was hollowed out, and the edges of the cup were lipped by a deep border of the best ivory, the effect was as charming as it was unique. The tops of snuff-boxes, the handles for various implements, such, for example, as his own hatchets for marking trees to be cut, and many other articles, were the products of his skill. He mended everything that was broken, even china. He made the steel rod to which the padlock of his private post-bag was attached, and well do I remember the lovely iridescent colours on the bar of soft iron which, in a carbonizing bath of hot charcoal, passed over the rod as the quality of steel was imparted to it.

The speciality of my father's work was its perfectness. All the joinings, as between wood and ivory or between different kinds of wood, were so smooth as to be impalpable. Nothing was done in a careless or slovenly way, nothing was scamped. Surfaces out of sight were as carefully attended to as those exposed to view. Nothing of strength or of solidity, in so far as these were requisite, was sacrificed to appearance. He used to inveigh against careless or superficial work as a discredit and disgrace. He maintained that in this respect there was a great difference between the British and the Continental—particularly the French—mechanic. French work, he said, was often super-

ficial—made for the eye alone—and constantly gave way under the actual stress of use. As an illustration, he used to take out of their case two French sporting rifles, which had been made for, and sent as a present to, General Napoleon Bonaparte when he was in Egypt. The vessel carrying this tribute was captured by one of our cruisers, which happened to be commanded by an old friend of my father's, a Captain Campbell (of Barbrech). The rifles, which were part of his prize of war, he sent to my father, and I still possess them. They appeared to be beautifully made—the stocks of fine wood elaborately carved, and the flint and steel locks highly wrought and ornamented. Among the apparent beauties of the locks were the 'pans' for holding the priming into which the flint sparks fell to ignite the charge. These pans had all the appearance of solid gold. But the first time my father tried the new rifles the deception was revealed; the pan, instead of being gold, had been only slightly gilt, and by the first discharge the gilding was, of course, corroded and destroyed. My father treated so seriously all such sins against the honour of true mechanical work that he always spoke of them with indignation and disgust. It was a splendid spirit of truthfulness carried into the work of the hands, and it was a constant and an inspiring lesson to me on the value of that spirit in all work whatever. One of the rules he used to lay down in his handling of tools, was never to use a tool for any purpose for which it was not intended. The tool, he used to say, might probably be spoiled, as well as the material to which it was wrongly applied, and the purpose, after all, not attained. In later years this rule has often come back upon me when I have heard the reckless use made of words which are the tools and implements of thought. They are perpetually misused and misapplied—to the great damage of their proper use, to the concealment of the grossest error, and often to the destruction of all sense of truth.

Then there was another lesson which I imbibed silently and unconsciously from seeing my father's work. I used often to wonder at his dexterity—how by a slight difference of pressure from his finger or his tool, or by an almost invisible turn of his wrist in holding it, great effects were produced on the block of wood or of ivory which was revolving before his hand. But there was another thing I saw, and that was that the finest and most beautiful patterns never were, and never could be, thus produced by any amount of mere manual dexterity. I saw that the exquisite concentric lines, the crossing and recrossing of which upon each other constituted the beauty of what were then called 'Rose lathe patterns'—these lines followed with absolute mechanical precision certain curves, and all the beauty depended on that absolute precision. I saw my father so setting the machine that, by its own structure, a certain wobbling movement was established in it when the whole was set in motion by the driving-wheel. My wonder was then transferred to that structure—to its adaptation to a definite end, so that the lovely pattern was the mere natural consequence of a mechanism prearranged for the purpose, and was thus, in a sense, automatically produced. I at that time connected this vivid perception with no argument of any kind, any more than I had long contemplated in the light of any argument the automatic action of the flight quills in a bird's wing. But in later life, when I came to read and hear of arguments which accounted for lovely effects in Nature by the mere natural consequence of some mechanical necessity, I fell back on my early education and on facts which revealed the fallacy. The automatic action in human machines, which plays a large and ever-increasing part in their efficiency, instead of being that part which takes us behind the power of human ingenuity, is precisely that part in which the agency of the human mind stands on its highest and most conspicuous level.