

NORTH CAROLINA STATE UNIVERSITY LIBRARIES



S00832134 L

This book is due on the date indicated below and is subject to an overdue fine as posted at the circulation desk.

EXCEPTION: Date due will be earlier if this item is RECALLED.

MAR 16 2002



Linnæus and the Furze-Lushes. 87 1.



EMINENT NATURALISTS.

BY

THOMAS GREENWOOD, F.R.G.S.,

AUTHOR OF

*"A Tour in the States and Canada," "Free Public Libraries,"
"Half Hour Papers." etc.*

London:

SIMPKIN, MARSHALL, & CO.,
STATIONERS' HALL COURT, E.C.

—
1886.

P R E F A C E.

THE age in which we live necessitates brevity, and average readers have not time for the perusal of voluminous biographies. It appeared to the author that there was a need of short yet comprehensive sketches of some leading naturalists, and he has attempted to supply that want. His desire has been throughout to stimulate a desire, particularly in the minds of the young, for Natural Science. Elementary lessons in Botany, Geology, and other subjects of a similar nature are now given in many Board and voluntary schools, and the author will be glad if this little book reaches the hands of some of these young students. He has endeavoured to interest the reader in the lives of a few of the men of light and leading in the study of nature.

LONDON, *January*, 1886.

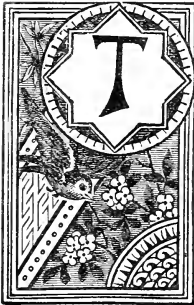
CONTENTS.



	PAGE
SIR CHARLES LINNÆUS	1
SIR JOHN LUBBOCK	34
THOMAS EDWARD	46
LOUIS JOHN RUDOLPH AGASSIZ	94
CUVIER	118
BUFFON	140
SIR CHARLES LYELL, BART.	160
SIR RODERICK J. MURCHISON	183

EMINENT NATURALISTS

SIR CHARLES LINNÆUS.



THE subject of this sketch was born on May 3rd, 1707. His father was pastor of the little village of Rashult, in the province of Smaland, Sweden. The family surname is supposed to have originated from a lofty lindentree which stood in the native place of their ancestors.

Charles was the first-born of the family, and, like many other men who have made the world famous, it was intended that he should follow the same calling as his father, and though the pulpit of that day may have lost an earnest and zealous teacher, botanical science has been the gainer, and in many ways it may be said that he has exerted a wider and more beneficial influence by the calling which he eventually followed than he could possibly have done as a village pastor.

His father, Nicholas Linnæus, was passionately fond of gardening, and living as he did in the heart of a beautiful country, in a house surrounded by ample grounds, he was enabled to gratify this hobby to his heart's content, and young Charles appears to have been born with this intense love for the same pursuit, and thus his parents themselves laid the foundation of what was afterwards to defeat their most cherished wishes, that he should enter the ministry. As a babe cooing in his wooden cot he was often carried into the open air amid the trees and flowers, and the lullabies of his mother were supplemented by the lullabies of the birds and the rustling leaves. His earliest attempts to walk were among the flower-beds, and his fingers daily revealed the handfuls of soil which he had been displacing. Even his very toys were flowers, and thus in the midst of such surroundings there could be no wonder that he should grow up a veritable child of nature.

A change of pastorate in 1708 took the family to another living, and here the father selected a house with a very large garden, which he soon cultivated to such an extent as to make it the finest and most variegated in the entire district. He had at one time in it upwards of four hundred species of flowers, many of them of foreign growth. Young Charles very soon made himself familiar with the names of the plants and flowers growing around their home, and almost as soon as he had found the use of his little legs he went out on private expeditions and brought home roots of weeds and wild herbs among

other things, and these he himself planted in the garden, giving his father great trouble to get rid of them afterwards. The boy, however, soon began to distinguish what he could bring home and plant with safety, and what he could not.

The time soon came when Charles was to attend his first school, and to Wexico, a neighbouring town, he was sent in 1717. His father had given him a good elementary education, and of Latin the boy's head had just about as much as he could well carry at that time; but, chief of all, his love for his favourite pursuit went with him, and it was fortunate that the rector of the school was also fond of botany, and soon took an additional interest in Charles when he discovered that he possessed extraordinary talents in quoting the names and peculiarities of plants and flowers which grew about the school. The majority of the school-companions of Linnæus were far ahead of him in the ordinary studies which they passed through, and looked upon Charles in the light of a truant in his self-imposed excursions after plants at the expense of Hebrew and the other subjects of the school course. So negligent did the boy become of these subjects, that the tutors, after many admonitions, considered it necessary to complain to his father, and this so disturbed the senior in his mind that Charles was severely reprimanded. He promised to pay all the attention which he could to divinity, but had to confess to his father that he possessed no inclination whatever for the sacred pursuit which he so eagerly desired him to

follow. The hopes of the father received a severe blow at this, and without delay Charles was apprenticed to a shoemaker.

How many examples are afforded from the lives of men whose parents have been unable to understand the bent of the son's mind have placed them in trades directly opposed to that for which they had the most liking! Luther was meant to be a lawyer, and became the greatest reformer which the world has known. Tycho Brahe was to have been a politician, and became an astronomer. Shakespeare was to have measured yards of cloth behind a draper's counter, and became the greatest play-writer of any age. Carlyle was intended for a parson, and became a philosopher; and so other instances might be quoted. No blame could be attached to the father of Linnæus for this decision. He naturally argued with himself, How could the boy make a living out of plants? and so, as he had no taste for theology, an honest calling, which would eventually be a livelihood for him, was selected. But there was to be one of many examples where "man proposes and God disposes," and young Charles' guardian angel was to be a physician in Mexico, who was professor of medicine in the college where Charles attended. This physician, John Rothmann by name, appealed eloquently to the father not to remove his son from college, but to let him study botany and physic; and to these entreaties he added an offer, which shows how fully he believed in the views he held concerning young Linnæus, and what large-heartedness he possessed. He generously recom-

mended that Charles should make one of his household during the remainder of the term for which he had been sent to Wexico, and with a suggestion such as this, the mother, who had a kindly and sympathetic nature, and the father, after a hard struggle, gave up their darling wish to see their son in a pulpit; and so Charles entered the house of Rothmann to study a little physic and a good deal of botany. Noble John Rothmann deserves to be remembered for his part of this transaction, and naturalists especially owe him a debt of gratitude.

The library of Rothmann contained some rare books on botany, and these became the eager study of the youth. He attended the school for three years, and then in his twentieth year prepared himself to go to the University of Lund in 1727. It was intended that he should reside in the house of a relative during his studies at Lund; but almost before he had arrived there he was informed of the death of his kinsman. He, however, entered the class of Professor Stobæus, the lecturer on physic and botany, and by means of the discourses of this tutor the botanical knowledge of Linnæus soon began to assume a definite form. The principles of the science became fixed in his mind. Stobæus noticed his diligence, and followed the good example of Rothmann, and took him into his own house. It was here that he first met with a well-arranged collection of natural history, and became acquainted with curiosities which he had never seen before. He at once began collecting a herbal for himself, and made many journeys into the neigh-

bouring districts for the purpose of enriching his collection. During one of these excursions he nearly became a victim to his own curiosity. While cutting a plant he was stung by a venomous worm. He was some distance from home, and his hand and arm began to swell visibly before his eyes. He at length reached the house of Stobæus, and there he kept his bed for some time, all hopes of his recovery having been given up. The skill of Stobæus, and the good nursing which he received in the professor's household, eventually saved him. This adventure, rather than deterring him from further collecting, only served to deepen his curiosity to become acquainted with some of the inferior classes of nature.

To the great regret of Stobæus, he decided to leave Lund for the University of Upsala, which was considered the better college of the two. His father could allow him only £8 a year towards his expenses. Under this small allowance, and with a young and increasing family, it was the most that could be done. No wonder that the pangs of hunger should be no uncommon occurrence to this studious youth. His shoes—and he was very hard on shoe-leather—were constantly in holes, and these he endeavoured, as well as he could, to stop up with paper. The cast-off clothes of the other students were the best covering which he could obtain. Sheer poverty stared him in the face, and a less determined youth would have given up his favourite studies in despair. This was one of the most distressing periods of his life, but he struggled manfully through it. Celsius, the professor of divinity at Upsala,

and himself a botanist of no mean order, discovered Linnæus one day in the gardens surrounding the college, intently examining a plant, and on entering into conversation with him he was astonished at the extent of the botanical knowledge which Linnæus displayed. This was the first of many conversations with him, and these eventually led to Celsius, where, for the literary assistance which he would be able to render his benefactor, he was to receive board and lodging free. The professor was engaged on an elaborate work on the plants and trees mentioned in the Bible, and it was in the compiling of this that he was to help. Celsius treated him with great paternal care and gave Linnæus free access to the extensive library which he possessed. Among the quiet of the books of Celsius and Rudbeck, another professor, Linnæus first conceived those schemes of classification, by which he was to revolutionise botanical science. He set to work to consider the plants, especially from their new and unimproved side, by their sexes, by the number of stamina, and compared them with the ancient system, and the divisions which had till then been used. As he progressed with his studies the more deficient did he find the ancient system. The sexes of plants now occupied his thoughts night and day, and the fresh knowledge which he obtained by these studies soon paved his way to better fortune.

The steps taken in Sweden at this time for the furtherance of botanical science deserve never to be forgotten. Professor Rudbeck travelled at the expense

of Queen Christina, for the purpose of collecting herbs and plants. He was a man of deep learning, and with considerable boldness gave utterance to principles which tended to completely upset some of the theories generally accepted up to that period. He was author of several valuable works, and his death was said to have been accelerated by the destruction by fire of work on which he had been engaged for some years.

Olaus Rudbeck succeeded his father as professor at Upsala, and as he greatly needed assistance in the botanical lectures, his choice for this work fell on Linnæus, for whom he had acquired a great liking. At this time Linnæus was twenty-three; but the vivacity of his instruction and the novelty of his matter charmed his audience, and he rapidly rose in favour in the college. His new plan of botanical reform took hold of him; but he very soon became acquainted with the difficulties and trouble which would attend the introduction of a new botanical system; but the prospects of honour and fame increased his zeal and impelled him to go forward.

A society had existed for some years in Upsala which had received royal sanction and assistance. The object of this society was to extend the knowledge of domestic natural history. The elder Rudbeck already named had some years previously undertaken a journey to Lapland to collect specimens of the flora and fauna of that country, at the expense of King Charles XI., but his collection had been destroyed in the great fire at Upsala in 1702. In



Linnaeus.

1731 the academy came to the decision to send out another traveller to make discoveries in that wild region; and the choice fell on Linnæus for this purpose.

On the 17th of May, 1732, he started on this journey to Lapland, with a very small allowance for travelling expenses, and without any promise of ultimate reward from the society; indeed, the whole sum which the academy devoted to this perilous and uncomfortable journey did not amount to ten pounds.

The only reliable biographer of Linnæus is Dr. Stoever, whose book was published in the Swedish language about the year 1785, and an English translation of which, published in 1794, says of this journey:—

Under these unencouraging circumstances he started alone, sometimes on horseback, and sometimes on foot, for Lapland. He was persuaded at various places to wait for milder weather, but being impatient of this, he resolutely pursued his journey. Trees, herbs, animals, mountains, and almost every curiosity of nature which offered itself, became the objects of his observation and attention. Difficulties and hardships surrounded him. Rivers over which he had to pass were often swollen and had rapid torrents, and so his life was often in danger. Bogs, forests, lack of provisions did not stop him, and often he had to content himself with a bed such as he could make of twigs and leaves. Fortunate did he consider himself if, after the hard and trying work of the day, he could discover the hut of some Laplander

where he could obtain food and rest for the night. It is said that, at the time of this journey through the various provinces of Lapland, it did not contain a single town, and only thirty-two scattered villages, some of which were only very small. It can be easily gathered how perilous and lonely this journey must have been. Linnæus said of this journey some years afterwards: — “My journey through Lapland was particularly toilsome: and I own that I was obliged to sustain more hardships and dangers in the sole peregrination through the frontier of our northern world, than in all the travels which I undertook in other parts, though not without fatigue and weariness. But having once sustained the toils of travelling, I buried in the oblivion of Lethe all the dangers and difficulties which I had suffered. The invaluable fruits which I reaped from these excursions compensated for every toil.”

He travelled during this journey about 4,000 miles, and brought back upwards of a hundred plants before unknown or undescribed; but, as before stated, his attention was not wholly absorbed with the plant^v region. He noticed the curiosities of the animal region, the domestic arrangements and customs of the inhabitants, and many other things which came in his way, making as he went along lengthy notes in his diary, and which were afterwards elaborated and published by him in 1748. In this he described the plants, not by their flower or blossom, but by his own plan of sex,

number of stamina or dust-threads, and the pistilla or dustways. From this work his system first dated.

The Royal Academy of Sciences, at whose suggestion he had made this journey, gave him very little encouragement on his return. They generously elected him an academician, but did not amend the insignificant allowance which they had made towards his expenses. Shortly after his return to Upsala he commenced to give lectures; but the success of these led to a complaint being made to the heads of the college that it was against the charter of the university that lectures should be given by any but those who had obtained the full academical degree. This opposition to Linnæus was carried to such an extent that, enraged and baffled, it was on one occasion only the interposition of the bystanders which prevented him from using his sword on the body of his chief opponent.

His situation became trying and critical. A few fellow-students rallied round him, and in 1733 they resolved to visit some of the mountainous regions of the country, and placed Linnæus at their head. Mineralogy was to be their especial study; and at Fahlun, noted for its rich copper mines, he was introduced to Baron Reuterholm, the governor of the province, who delighted in studies of nature. He grew fond of Linnæus, and eventually placed his two sons under his care during a travelling tour which the baron wished them to undertake. A few other young nobles joined them, and each had assigned to him a particular and separate branch of observation.

On their return, Linnæus established a little college under the auspices of the baron, and here his lectures and experiments on the assaying of metals and other subjects brought him friends and money. They did something more: they brought across his path a young lady who was destined to become his wife. She was the daughter of a physician, to whom a certain baron had paid his addresses, but without success. After having won the heart of the young lady, the lady's father had next to be consulted, and although he was partially inclined towards Linnæus, the uncertain income of the wooer was the barrier; and the father finally declared that his daughter should remain unmarried three years longer, and at the end of that time he would give his decision.

The three years passed, and at the age of twenty-seven Linnæus had a bride; but even then his prospects were far from bright. His father-in-law advised him to study medicine more closely. He became anxious to obtain his degree; but poverty stood as a great barrier. With the aid of some earnings of his wife, he started with £15 in 1735 for Holland, to obtain there a diploma which would enable him to practise physic as a livelihood, or to lecture at the universities.

He took a circuitous route in order that he might have an opportunity of visiting collections of literary curiosities as well as of natural history, of which several cities boasted. At Hamburg there was one of such collections which occupied his attention for some considerable time. An amusing incident occurred at the museum in this city, which, although it added

somewhat to the already high reputation of young Linnæus, placed him for the time being in a somewhat unpleasant dilemma. The eminent founder of the collection had for years been looked upon as the fortunate possessor of one of the most marvellous specimens in the whole animal world, being no less a phenomenon than a serpent with seven heads. This curiosity had been one of the most interesting specimens in the museum, and great was the dismay of the founders to learn, after a careful inspection by Linnæus, that the prodigy was the work of a very clever taxidermist, who appears to have added to the serpent's one head the jawbones of weasels artfully covered with serpent's skin.

This serpent had been lodged as security for a loan of £500, and the seven heads had been readily accepted as ample guarantee for the money. But its value was hastily shattered, and after much contention, it was insisted that Linnæus should prove, before a carefully-selected committee, his statements respecting the serpent. This he was prepared to do; but a Dr. Jaenisch advised him to leave the city at once, in order to avoid delay and litigation, and this he did.

This little incident shows how imperfect was much of the scientific knowledge of that day, and also shows the wide knowledge of nature which Linnæus had acquired.

He succeeded in obtaining his degree: after three examinations and a public defence of his treatise, he was rewarded with the dignity he so well merited.

After this he spent some time at Leyden, then the seat of the leading Dutch university, where he made friends with several naturalists. One of these strongly advised him to publish the result of his inquiries and investigations. Acting upon this advice, he published a prospectus occupying fourteen folio pages, giving his *Systema Nature*, which has proved the foundation of his fame. A celebrated Dr. Boerhaave took notice of him, and invited him to his villa some distance from Leyden, where he had a botanical garden. The doctor had among his trees one bearing the name of *Crategus Aria*, which was looked upon as a rarity. Linnæus was asked if he had seen the tree before, and he replied that he had, and that he had also read the description of it in a book by Vaillant. The eminent medical man doubted this, and went so far as to say that his visitor must be greatly mistaken; and to prove himself in the right, went to his library and brought back the book and referred, when to his great astonishment he found that Linnæus was right, and that he had most accurately rendered the description as given by Vaillant.

On Linnæus leaving Leyden for Amsterdam, Dr. Boerhaave gave him a letter of introduction to a pupil of his who was professor of botany in the capital of Holland. This Professor Burmann was engaged at the time of his visit in completing a description of the plants of the island of Ceylon. In the course of conversation Burmann showed him a shrub which he said was a great rarity. Linnæus examined it, and pronounced it a species of bay.

After further interviews, Burmann induced Linnæus to remain in his house in order to aid him in the work he had in hand, and Linnæus, with his slender resources well-nigh exhausted, was glad to avail himself of the board and lodging offered in exchange for his services, so that he might be able to pursue his studies.

The Dr. Boerhaave already mentioned now rendered Linnæus a further most valuable service. He had a patient, by name Cliffort, who was very rich, and who had spent large sums of money in acquiring treasures of every description from all parts of the world; but these he kept in a veritable Olla Podrida fashion, without almost any attempt at classification. He was a man who was always imagining himself ill; and Dr. Boerhaave advised him to keep a physician of his own, and to fill this post he recommended a young Swede then at Amsterdam, who was qualified as a doctor, but was also an excellent botanist, and this was Linnæus.

Burmann and Linnæus were invited without delay to the house. In the gardens and hothouses were many rare and curious productions from the Cape of Good Hope. Linnæus displayed such knowledge of these, that Cliffort, on Burmann's expressing his pleasure on seeing a newly-arrived volume, "The Natural History of Jamaica," said that Burmann might have the copy with pleasure if he would leave him Linnæus by way of exchange. His offer was that of a home and an allowance of 1,000 florins per annum. And this house of Cliffort's at Hartecamp became the

school of his greatness. The villa was surrounded by treasures from all parts of the world, and there was everything for which Linnæus could possibly wish. In 1736, while here, he published a crude edition of his "Fundamenta Botanica," which fifteen years later he greatly extended and revised. Following this was his "Bibliotheca Botanica," and after this a third book appeared.

These productions established his fame, while the new principles which he put forward attracted universal notice. Naturalists in various countries began to inquire as to who this new teacher was, and several learned bodies in Germany and elsewhere admitted him to a fellowship of their associations.

In 1736, at the expense of Cliffort, Linnæus visited England, an opportunity for doing which he had long wished for. Mr. Cliffort was desirous of enriching his garden with foreign, and especially with North American plants. He brought with him a letter of introduction to Sir Hans Sloane, who was a collector of objects of natural history, and afterwards the founder of the British Museum. The letter was from Boerhaave, who said in it:—"The bearer of this letter is alone worthy of seeing you—alone worthy of being seen by you. He who shall see you both together, shall see two men whose like will scarcely ever be found in the world."

Sir Hans Sloane does not appear to have received him very cordially, notwithstanding the elaborate letter of introduction which Linnæus brought with him.

Linnæus had for years desired to see the botanical

gardens then situated at Chelsea. Philip Miller was then curator of the grounds, and several amusing incidents are related of the early interviews between the young Swede and this celebrated botanist, who died, it may be mentioned, in 1771.

Singular to say, at the elaborate explanations of Miller in showing the various specimens, Linnæus was silent, and this somewhat tried the patience of Miller, who was indiscreet enough to say to a friend near him at the time, but sufficiently loud to be heard by Linnæus—"Sure, the botanist of Burgomaster Cliffort is a great man—*he knows nothing at all of plants.*" Miller was particularly fond of giving the ancient names to the various plants. Linnæus said, "Why do you apply these, pray? We have better and conciser appellations." Linnæus very soon showed the curator that he had more knowledge of botany than he would at first have given him credit for; and it is significant to note that in after years the collection at Chelsea was arranged according to the Linnæan system.

It is told of Linnæus that when he first saw a common near London, covered with furze bushes in full bloom, he fell on his knees (see frontispiece), and, with tears, uttered his thankfulness for so glorious a sight. When he returned to Sweden he took with him some plants of furze, but they could not live through the northern winter.

From London Linnæus went on to Oxford, where there was a capital botanical garden. Here he was made sport of just as he had been at Chelsea, the curator

at Oxford remarking to a person while in the presence of Linnæus, that he (Linnæus) was the young man who confounded all botany. After a time, however, he got on better with these learned sages, and procured many valuable specimens from both Chelsea and Oxford for the garden of his employer, Mr. Clifford.

Linnæus, after a brief stay in England, returned to Holland, and very soon became absorbed in his system of botanical reform. Stoever says of him at this time: "It required a strong and forcible progress to bring about such a revolution; and, in fact, no time during the whole life of Linnæus was more distinguished by an extraordinary activity, none more fertile for the republic of science than the year 1737. It was in the course of this same year when Linnæus published about 200 printed sheets. Such a deal of writing would have been no novelty, and the young Swede had long before been excelled in it. But what constituted its pre-eminence was, that the six works which Linnæus published in the course of the year, and which diffused the reform of botany from Hartecamp throughout Europe, were all original, and by more than one-half large classical works, replete with the most difficult researches, new representations, and accurate critical doctrines. It would have done infinite honour to his diligence had he only produced one of those works in a whole twelvemonth. The plans and materials for some of them had certainly been previously collected, but the whole required to be digested and arranged."

The "Genera Plantarum" was the first book

which Linnæus published after his return from England, an octavo book of 384 pages. He described in this book upwards of 935 species of plants. This was followed by other books, one of them being a very comprehensive descriptive and scientific account of Mr. Clifford's collection.

To Linnæus we owe much for having simplified the study of botany. A frequent remark of his own was that the maze of ancient names "resembled a chaos, the mother of which was ignorance, the father custom, and the godfather prejudice." He wrote to a friend, "Why should we retain such useless jargon as *Monolasiocablenomenophyllorum*, *Hypophylocarpodendorum*, and all the whole family of these outlandish names?"

So he attacked the old system in vigorous language, meeting with much severe criticism, opposition, and ridicule.

In the midst of all this work financial difficulties surrounded Clifford, and he was obliged to leave his beautiful villa and its valuable gardens, and shortly after this event he joined a collegiate acquaintance at a salary of 800 florins a year, to aid in the rearranging of the botanical garden at Leyden. While engaged in this work he published two other works, which added materially to his reputation, and he was now beginning to see the object of his ambition gratified, and the accuracy of his method acknowledged.

The Dutch Government proposed to him to go out to the Cape of Good Hope on a botanical expedition at the expense of the Republic, and on his return

they promised to give him the professorship of botany in a Dutch university, but this offer he declined.

It will be remembered that the future father-in-law of Linnæus had fixed three years as the period for which he must wait for his intended bride. These three years had passed, and Linnæus had been absent almost the entire period, corresponding with the fair Elizabeth, to whom he was greatly attached. A rival to him appeared, and endeavoured to persuade her that her lover would never return to Sweden; but a friend of Linnæus, who knew his feelings well, told Miss Moræus exactly how matters stood, and so the intentions of the rival were quite frustrated.

Linnæus wished to travel further, and visited Leipsic, Upper and Lower Saxony, Denmark, and Paris, which city he had longed for some time to visit. One or two learned men said of him in Paris that he was "a young enthusiast who confounds all, and whose sole merit consists in having plunged botany into a state of anarchy." One naturalist, Guettard, however, said, "Don't laugh, good people, don't laugh at Linnæus, the time will come when he will laugh at you all." And so it was, for in later years, the royal gardens were arranged according to his system. Several literary honours were conferred on him during his stay in Paris. From the French capital he started for Stockholm.

The period of his career had now arrived when he was to experience severe opposition to his system and much criticism from his contemporary botanists. These were very numerous, and there was on the

part of some much rancour and personal antipathy displayed. He promulgated his theories, to his credit be it said, without intentionally wounding the feelings of others; but this did not prevent him from making a very vigorous defence of his system when there was need. Botanists twice his age were somewhat chagrined that one so young should thus boldly seek to overthrow the methods which they had all adopted for so many years.

Many of his opponents were men of great reputation, and in some cases of high social standing. One of these wrote of him as follows: "Linnæus, a pupil and friend of Baron Haller, with whom he was well acquainted by several years of domestic connection, had in the course of a few years pulled down the whole structure of botany, that he might erect on the ruins of his predecessors his own system: he rejected everything foreign to his own precepts, and sent the greatest botanists into a school, where they were first to learn the signification of the names he had created and the laws of his system. Haller, with placid eye, saw this mighty dictator step forth; he was not insensible of the necessity of a reform, but saw at the same time, that he went too far. He followed Linnæus wherever he thought the truth was his guide, but where the latter only dealt in hypotheses, he there quitted him."

It is impossible to follow all that was said against Linnæus at this time; but in his system thus being severely criticised and examined it only made its ultimate success the more assured.

During the year 1737 he received many congratulatory letters from eminent botanists in all parts of the world. Sir Hans Sloane wrote: "I am so uncommonly pleased with your "*Flora Laponica*" that I very much wish to see the other parts of the natural history of that country completed, and publicly described by you."

Linnaeus published the last edition of his "*System of Nature*" in 1766, when he was advanced in life, and in his preface he says: "I have ranged through the thick and shady forests of nature; I have to and fro found sharp and perplexing thorns, I have, as much as possible, avoided them; but learned at the same time that foresight and attention do not always conciliate perfect and entire safety. I have therefore quietly borne the derision of grinning satyrs, and the jumps of monkeys upon my shoulders. I have entered the career and completed the course assigned by fate."

He reached Stockholm in the September of 1738, after an absence of three and a-half years. The return was a source of pleasure to him. It was only natural that he should anticipate, after his laborious researches and fatiguing travels, honours and respect would be paid him. But alas! with him as with others, he was to experience the disheartening truth that "a prophet has no honour in his own country." College dignitaries and professors made sport of his botanical knowledge, and ridiculed his pretensions.

Again did the necessities of life compel him to

seriously consider what he was to do for a livelihood, for botanists must eat as well as other mortals, and he forthwith turned his attention to medicine and the curing of patients. In this he was not by any means successful at first, for the public were not slow to grasp the fact that even if he were good as a botanist, a botanist was one thing and a doctor another; and so he had many clouded days, and fortune appeared to have deserted him.

A gentleman in a good position in Stockholm suffered from what had been termed an incurable complaint, but in a fortnight Linnæus, either by superior skill or one of those fortunate events of life, he was able to cure his patient in a fortnight; and soon his fame spread in the city, patients became abundant and fees plentiful. One of the ladies in waiting on the Queen of Sweden had a cough, and Linnæus had been asked to prescribe for this. He made for the lady some lozenges which she could always carry about with her. One day while she was engaged in playing a quiet game of cards with the Queen, the Queen noticed her place something in her mouth, and asked what it was. The Queen had a cough at that particular time and became interested in the remedy. Linnæus was called in, and cured the Queen almost immediately; and so this troublesome cough gave him such a step upwards that he never afterwards looked back.

With such assured success, the future father-in-law could no longer withhold his consent to the marriage of his daughter with Linnæus, and they were married

in June, 1739, after some years of patient working and waiting, which made him, however, none the worse husband.

Linnaeus had now many friends in influential positions, and it was his desire to found a learned society in Stockholm similar to what Berlin and Goettingen then possessed. Such a society was founded in Stockholm, with six members, and himself as the first president, in the same year as his marriage took place. The membership increased, and in two years' time it was constituted the Royal Academy of Sciences. The society still exists and has done much good in making known useful knowledge and discoveries.

He still continued his practice, which had by this time produced him a splendid income. In 1741, he was selected by the state to travel into unexplored parts of Sweden for the purpose of discovering plants which might be useful for dyeing purposes, and also to search for a suitable clay for the making of chinaware.

At the age of thirty-three he was appointed professor of physic and anatomy in the university of Upsala. The botanical gardens of the city had been allowed to fall into a condition of neglect, and Linnaeus devoted now several years to their care and development. In 1745, they had, under his skilful management, not only recovered their former prestige, but would now compare very favourably with the gardens at Kew, Paris, and elsewhere. The embellishing and enriching of these botanical gardens at Upsala was the favourite study of his life. His academical lectures on botany were delivered to crowded audiences, and new life was

altogether infused by him into the university. The number of students was usually about 500, but during the year 1759, when Linnæus was rector, the number had grown to 1,500, and to profit by the instruction of so able a teacher, students had gone from England, Russia, and even America.

He gave lectures on botany, natural history, the medicinal virtues of plants, the *Materia Medica*, and on the dietetics and knowledge of diseases. One of his most eminent students said of him: "Science streamed with peculiar pleasantness from his lips. He spoke with a conviction and perspicuity, which his deep penetration, his clear notions, and ardent zeal inspired him with. It was impossible to be near him without attention, without participating in his enthusiasm. He communicated to his pupils the greatest part of the ideas and materials of the thirty disputations which were held under him till the year 1750. They contained real treasures and elucidations of science."

Not only did Linnæus make valuable additions to botanical literature at this time but he published a description of the Swedish animals, birds, insects, and other branches of natural history.

Honours now followed each other quickly. A medal was struck, showing on one side a bust of Linnæus, and on the other a flattering inscription.

His father died at the age of seventy-four, in 1748, and a year before that time his son, whom he had at one time designed for a shoemaker, was made Dean of the College of Physicians.

As with grand old Martin Luther so it was with Linnæus—he belonged to the world, for his researches benefited not alone Sweden but the whole of Europe. His lecture-room became the nursery of eminent men. His enthusiasm, his thirst for science, became their own, and he gave them opportunities to exert those qualities. From Upsala the pupils of Linnæus travelled to all quarters of the globe to study nature.

Linnæus at this period says:—“If I look back upon the fate of naturalists, must I call madness or reason that desire which allures us to seek and examine plants? The irresistible attractions of nature can alone induce us to face so many dangers and troubles. No science ever had so many martyrs as natural history. Pliny, the prince of nature among the Romans, plunged into the fiery abyss of Mount Etna. Simon Pauli, from his love of plants, broke his leg; Clausius, an enthusiast, equally unfortunate, was thrown into irons and robbed of all his treasures in Barbary; Lippi was murdered in the wilds of Ethiopia; Steller fell a victim to his exertions in Siberia; Gmelin was thrown into a dungeon by the Tartars; Bannister was hurled headlong down a rock in Virginia; Barelli, and others, without number, fell a sacrifice to their scientific exertions in natural history.”

Many of the pupils of Linnæus fell victims to science. One died in India in search of specimens. Another, a brave youth, died after he had travelled through Palestine and some parts of Arabia, having made a very valuable collection of plants and other

things. Three others of his students found graves in Asia.

Although not a few of his pupils thus met with death early in life, Linnæus had many pupils who were more fortunate in their career. One, Sparrmann, accompanied Captain Cook in his voyage round the world, and was afterwards engaged at the British Museum until his death.

The academic career of a college professor and principal will almost of necessity be the most important part in the entire life of that individual; and it was during the ten years between 1750 and 1760 that the reputation and learning of Linnæus became consolidated and ennobled.

It was during this period that the royal museums of Sweden received the greatest amount of attention from the nation; and in 1754 Linnæus arranged and published a description of some of these collections.

During the period named Linnæus spent much time in the royal palaces of Sweden, classifying and cataloguing the collections, but became for some time very subject to gout. Whether the cure effected in him may be worth anything I do not know, but he ate most liberally of strawberries, and to this habit he attributed the disappearance of this troublesome complaint from his system.

Botanists have for centuries been open to the charge of giving unpronounceable and impossible-to-be-remembered Latin names to their specimens. Linnæus was about the first to introduce the common names. One writer of that time said: "If a woman, or any of

those men who are so much like them, asked the name of some herb or garden flower, than to throw up, by way of answer, a long train of Latin words, which sounded like a conjuration of hobgoblins.”

Had Linnæus done nothing else but this, it would indeed be a noble monument to his memory. The applying of simple names by him promoted and facilitated the study of botany. It got rid of the deterring appearance of an arduous science. Particularly did it popularise botanical studies among the fair sex, and Linnæus had no greater admirers than the Queen of Sweden and her family and other ladies immediately connected with the court. Not only was Linnæus on terms of intimacy with the Swedish royal court, but in 1773 he received an offer from the then Spanish king to be chief botanist in the Madrid gardens at a high salary, accompanied by an offer to at once create him a nobleman. This flattering proposal he declined for himself, but obtained it for one of his own pupils.

All through the studies of Linnæus he kept strictly in view the curative properties of plants, as well as the furtherance of botanical science. His work, the “*Materia Medica*,” which was for years the best book on medicine, shows how much of a doctor as well as a botanist he was. He laboured long and earnestly to reduce diseases to definite and certain species with as much accuracy as a botanist he had done with regard to the description of plants.

Honours began freely to fall upon him. The different academies of Europe vied with each other

which of them should first have the honour of electing Linnæus one of their members. The Royal Society of London elected him a corresponding member in 1763, following as they did the example set by Paris, Florence, and other cities. Frederick the Great, King of Prussia, spoke in the highest terms of encomium of the work and private life of Linnæus.

About this time he received the honour of knighthood. His public activity continued up to 1776, when he had reached his sixty-eighth year. Then the feeble and infirm state of his health suffered a fresh shock; his senses appeared to be losing their power, and his tongue, palsied as it were, almost denied its office. His biographer states that "even in this melancholy and painful state nature still remained his only comfort and relief. He used to be carried to his museum, where he viewed the treasures which he had collected with so much labour, and manifested a particular delight in examining the rarities and new specimens which were constantly being sent to him from all parts of the world."

Apoplexy again seized him, and after much physical suffering he expired in a gentle slumber on January 10, 1778.

He received a public funeral, and the king ordered a gold medal to be struck in honour of the late botanist.

Probably the highest monuments which have been erected to his memory are the Linnæan societies which have been established at various times in the leading cities of the world. That in London was founded

in 1788, and has connected with it to-day men of great scientific research and renown. This society was preceded by one established in Paris, and was followed by one in Leipsic, established in 1790.

The royal prince of Denmark had a service of porcelain made, on which the flora of his country were painted, according to the Linnæan system.

It is impossible in a limited space like the present to give a list of the published works of the great naturalist. Many of these were distinguished by great research and thought.

His activity during the working years of his life was as great as his thirst for truth. The strictest order, the most punctual regularity, distinguished all his actions. In the summer he usually slept five hours, rising at three in the morning, and in the winter he invariably rose at six. He was most genial and kind in manner, a true and tender husband and father to the six children who were born to them.

With a keen remembrance of his own poverty, he frequently returned the class fees to the poorer students of the university of Upsala.

His coat of arms included the motto, "To spread fame by deeds." Throughout his life he had a profound adoration of the Divinity, and never lost sight of this in all his researches. Whenever he found an opportunity of expatiating on the greatness, the providence, the omnipotence of God, which frequently happened in his lectures and botanical excursions, his heart glowed with emotion, and a deep religious fervour entered into his discourses.

His habits were simple, and he at all times displayed great kindness of heart.

During the more than a century that has passed since his death, his fame has not decreased. It is true that to-day he is looked upon more as a classifier than a discoverer. He reduced chaos in botany to order by a system of sexual classification, which has greatly benefited the entire world of science.

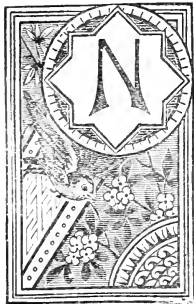
He was the great master-mind which named and arranged botanical science, and whose efforts, more than the efforts of any other single individual, either before or since his death, gave an impetus to studies which have given joy and intelligence to thousands of all countries.

Botanical science owes much to Linnæus, and for centuries to come he will receive the homage of posterity.





**SIR JOHN LUBBOCK, BART., M.P.,
F.R.S.**



o apology is required for introducing the name of this well-known public man in this book. Amidst a busy commercial and political life, Sir John Lubbock makes time to pursue natural history studies with all the zest of a born naturalist.

Anyone who has come in contact with him cannot fail to have been struck with his exceedingly clear and forcible sentences in expressing himself.

Science has from earliest years possessed great charms for him, and in 1881 he filled a well-deserved position in the presidency of the British Association for the Advancement of Science, and gave on the occasion of the annual meeting an address full of vigour and suggestiveness.

He was born on April 30th, 1834, so that now he is in the prime of life, and is one of the busiest



Sir John Lubbock, M.P.

yet most accessible of our public men. He comes from a very good stock. The connection of the family with the bank in Lombard Street dates back to 1750, and in monetary matters Sir John has taken a most active interest.

His seat at High Elms, near Farnborough, Kent, is beautifully situated in the midst of an estate of some fifteen hundred acres. Here most of those experiments with, and observations of, insects, crustacea, &c., have been carried on, and in these natural history pursuits he has been greatly aided by his daughters and nieces. The late Mr. Charles Darwin, whose memory will be the more honoured the more he is understood, was for a long time a near neighbour of Sir John Lubbock, and their frequent intercourse gave, no doubt, depth and definiteness to the studies of Sir John, and in the papers read before the various learned societies, and in the books he has published, it is very evident how greatly his mind was impregnated with Darwin's theories and principles.

In the very first speech made by him in Parliament the subject under discussion was education, and in the course of his speech he said: "Every one who loves children must know that they are eager for information—that they long to understand the facts of nature, and how every bird and beast and flower is a wonder and a delight to them." In 1879 he made a motion in the House of Commons for the introduction of science-teaching into elementary schools.

His own studies in natural history were in the first instance chiefly devoted to the structure and character of certain groups of insects and crustacea. Much that he has written on points of dispute and uncertainty on fixed points in connection with these has an interest only for the specialist.

There is, however, much that he has written and spoken which has been within the comprehension of the general public, and on the habits and peculiarities of ants in particular he has caught the popular style; and naturalists owe him a debt of gratitude for probably more than any other writer having familiarized the public with most interesting facts respecting ants; and further than this, has given to many young folks and adults to take up the study of the lower forms of insect life.

Those who have heard him lecture know full well with what an interest he envelops his subject; and by way of illustrating his style I will give portions of a lecture on "Ants" which he delivered some time ago before the Leeds Philosophical Society.

Sir John Lubbock, in the course of his lecture, said that to the true lover of nature there was no one species of animal or plant which would not repay even the devotion of a lifetime. No doubt some were more interesting than others, and few more so than the ant. In bodily structure monkeys approached nearer to man than did any other animals, but when we considered the habits of ants, their social organisation, their large communities, their elaborate habitations, their road-

ways, their possession of domestic animals, and even in some cases of slaves, it must be admitted that they had a fair claim to rank next to man in the scale of intelligence. In this country we had thirty kinds; but ants became more numerous in species, as well as in individuals, in warmer countries, and more than one thousand were known. No two species of ants were identical in habits, and, on various accounts, their mode of life was far from easy to unravel. In the first place, most of their time was passed underground. All the education of the young was carried on in the dark. Again, ants were essentially gregarious, and within the same species the individuals seemed to differ in character, while even the same individual would behave very differently under different circumstances. The life of an ant fell into four well-marked periods,—those of the egg, larva or grub, the pupa or chrysalis, and the perfect insect. Under ordinary circumstances an ants' nest, like a bee-hive, contained three kinds of individuals—workers, or imperfect females, which constituted the great majority, males, and perfect females. There were, however, often several queens in an ants' nest, while there was never more than one in the hive. The queens had wings, but after a single flight they tore off their wings and did not again quit the nest. Ants had their desires, their passions, even their caprices. The young were absolutely helpless. Their communities were sometimes so numerous that, perhaps, London and Pekin were almost the only human cities that could compare with them. They were organized communities,

labouring with the utmost harmony for the common good. Various observers had recorded, in the case of ants, instances of attachment and affection. In the whole course of his observations he had never seen a quarrel between two ants belonging to the same nest; within the limits of the community all was harmony. On the other hand, it must be confessed that ants not belonging to the same nest were always enemies, even if belonging to the same species. Among ants, as among men, all were not Good Samaritans. Numerous experiments he had made, with a view to test the characteristics of ants in this and other matters. He had even gone so far as to make a number drunk by putting them into spirits, since no ant would voluntarily degrade herself by getting drunk. The sober ants seemed much puzzled at finding their friends in this helpless and discreditable state. They took them up, and carried them about for a while in an aimless sort of way, as if they did not know what to do with their drunkards any more than we do. Ultimately, however, the results were these: the ants removed twenty-five friends and thirty strangers. Of the friends twenty were carried into the nest, and five were thrown into the water. Of the strangers, on the contrary, twenty-four were picked up, taken to the edge of the moat, and thrown, or rather dropped, into the water; only six were taken into the nest, and these were shortly afterwards brought out again and thrown away. Ants had the power of remembering and of recognizing their friends, and had been known to fall into mutual caresses with their

antennæ. In most species the power of smell was very keen. On the other hand, as regarded their sense of hearing, the case was very different. Over and over again he had made the loudest and most shrill noises he could with a penny pipe, a dog-whistle, a violin, as well as the most piercing and startling sounds he could produce with his own voice, all without effect. At the same time he would not infer from this that they were really deaf, though it certainly seemed that their range of hearing was very different from ours. Our range was, however, after all, very limited, and the universe was probably full of music which we could not perceive. It was far from improbable that ants might produce sounds entirely beyond our range of hearing; indeed it was not impossible that insects might possess a sense, or rather perhaps sensations, of which we could no more form an idea than we should have been able to conceive red or green had the human race been born blind. The organs of vision were in most ants very complex and very conspicuous. There were generally three eyes, arranged in a triangle on the top of their heads, and on each side a large compound eye, containing sometimes more than 2,000 facets between them. The single eyes probably saw in the same manner as ours did. But how about the compound eyes? There were two theories as to the manner in which these eyes saw. One supposed that each facet acted as a separate eye. But if the male ant saw a thousand queens, only when one was really present, it would seem a very

bewildering privilege. The prevailing opinion of entomologists now was that each facet took in one point of the field of view, so that, in fact, they saw a sort of mosaic. But even this theory was open to serious objections, and the whole question was full of difficulty, and one of many still remaining to be solved. From experiments he had made, he concluded that ants were capable of distinguishing between different colours. He had gone beyond, and had attempted to determine how far their limits of vision were the same as ours. These attempts had satisfied him that ants perceived rays at the violet end of the spectrum which to our eyes were quite invisible. Nevertheless, the sight of ants did not seem to be very good. Much of what had been said as to the powers of communication possessed by bees and ants depended on the fact that if one of them in the course of her rambles had discovered a supply of food a number of others soon found their way to the store. This, however, did not necessarily imply any power of describing localities. If the bees or the ants merely followed their more fortunate companion, or if they hunted her by scent, the matter was comparatively simple. If, on the contrary, the others had the route described to them the case became very different. Under ordinary circumstances, if an ant discovered a stock of food she carried as much as possible away to the nest and then returned for more, accompanied generally by several friends. On their return these brought others, and in this way a string

of ants was soon established. He concluded from numerous experiments that when large numbers of ants came to food they followed one another, being also, to a certain extent, guided by scent. The fact therefore did not imply any considerable power of intercommunication. On the other hand they certainly could, he thought, transmit simple ideas. Experiments, moreover, seemed to indicate the possession by ants of something approaching to language. It was generally stated in entomological works that the males of ants died almost immediately. No doubt this was generally the case. It had also been the general opinion that the females lived about a year. He had found, however, that the life of the queens and workers was much longer than had been supposed. He had now two queens which had lived since 1874. They must therefore be at least nine years old. He had also kept workers alive more than seven years. In industry ants were not surpassed even by bees and wasps. They worked all day, and in warm weather, if need be, even at night too. As a general rule each species lived by itself. There were, however, interesting exceptions. Most ants, indeed would carry off the larvæ and pupæ of others if they got a chance, and this explained, or at any rate threw light upon, that most remarkable phenomenon, the existence of slavery among ants. The food of ants consisted of insects, great numbers of which they destroyed, of honey, honey-dew, and fruit—indeed, scarcely any animal or sweet substance came amiss to them. Our English ants did not

store up provision for the future. Their food was not of a nature which would admit of this. Some of the southern ants, however, laid up stores of grain. Some at least did take steps to provide themselves with food for the future. Ants were not without their enemies. In addition to birds and other large foes were some very small flies of the genus *Phora*, that might be observed in summer every now and again making a dash at a particular ant. Curiously enough there seemed to be in ant life three principal types, offering an analogy to the three great phases in the history of human development—the hunting, the pastoral, and the agricultural stages. In face even of the facts upon record, it was impossible not to ask ourselves how far were ants mere exquisite automatons, how far were they conscious beings? When we saw an ant-hill, tenanted by thousands of industrious inhabitants, excavating chambers, forming tunnels, making roads, guarding their home, gathering food, feeding the young, tending their domestic animals, each one fulfilling its duties industriously and without confusion, it was difficult altogether to deny to them the gift of reason. Observations tended to confirm the opinion that their mental powers differed from those of man not so much in kind as in degree. In conclusion, he might say that, notwithstanding the labours of many great naturalists, there were in natural history few more promising or extensive fields for research than the habits of ants.

Some of his papers and addresses, particularly one

on the "Origin of Civilization," have created long and warm discussion ; but even those who differ radically from his conclusions acknowledge the earnestness with which Sir John desires to seek truth in all his researches.

English naturalists may well be proud of Sir John Lubbock, and his reputation has spread far and wide ; and foreign learned societies have not been slow to recognize the value of his position as a scientist. He has received the degree of LL.D. from the University of Dublin, from the University of Oxford the degree of D.C.L. The best degree of all, however, lies in the fact that when he writes or speaks, particularly on science subjects, a very large proportion of our population stop to read or listen to one of the subjects upon which he is now a recognized authority. We trust that for many years Sir John Lubbock may be spared to pursue those subjects dear to him, and to enlighten the public on subjects of natural science.



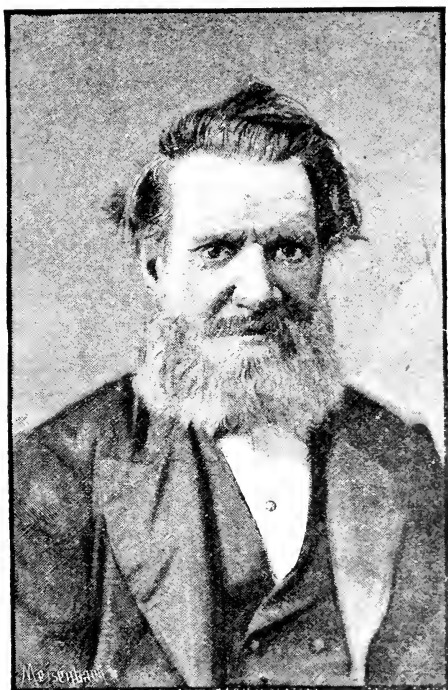


THOMAS EDWARD.



SCOTLAND has reared prominent men in almost every branch of scientific and philosophic literature. Her annals are full of the records of men who, with no greater stock in trade than average brains, indomitable perseverance and laborious consistency in a particular direction have yet become renowned in the specific branch or branches of study to which they have devoted attention. The country beyond the Tweed in fact breeds men, but cannot keep them, and British reputation has been ably maintained and increased by numerous examples furnished by her sturdy sons.

Many eminent naturalists are of Scotch birth or descent; but it is only with one of them that at the moment we wish to deal, and he is so thoroughly representative of a large number of his countrymen, that a brief sketch of his life will but illustrate much that might be said of many.



Thomas Edward.

From Photo. by Bremner, Bangf.

The passion for Natural History which possessed Thomas Edward from his earliest years, was not inherited from his father or mother, for neither parent appears to have had even the most ordinary proclivities for the study of nature. The father of Edward at the time of his birth was a militiaman, and Thomas saw the light of day at Gosport, where the regiment was at that time stationed. This took place on Christmas Day, 1814, and a few years afterwards, on the disbanding of the militia, the father and mother took up their residence in Aberdeen, where they remained for some years.

How Edward first acquired a taste for natural history he never knew, but it is very certain that from his earliest years he displayed the most precocious tendency for insects, and in fact, any representative of the animal world which came under his notice. When asked the question in his old age what was the origin of his love for natural history, by Dr. Samuel Smiles, who has devoted one of his most readable and instructive biographies to Thomas Edward, he replied, "I suppose it must have originated in the same internal impulse which prompted me to catch those flies in the window." (This he had made vigorous attempts to do when a mere babe in his mother's arms.) "This unseen something—this double being, or call it what you will, inherent in us all, whether used for good or evil, which stimulated the unconscious child to get at, no doubt, the first living animals he had ever seen, at length grew in the man into an irresistible and unconquerable passion, and engendered in him an insatiable longing for, and earnest desire to be always amongst such things." This was

the only reason he could ever give for being a lover of nature.

At the age of ten months he could walk, and no sooner had he found the use of his legs than he would toddle out among the ducks, hens, cats, and dogs. A litter of pigs greatly excited his curiosity, and when he was missing and his mother asked, "Where's Tam?" the answer as a rule was, "Oh! he's awa wi' the pigs." The father of Edward was a weaver at one of the mills outside Aberdeen, and the cottage in which they lived was in close proximity to several small streamlets running into the sea. These were prolific in eels, worms, crabs, and snails, and a neighbouring heap of refuse provided him with beetles, insects, rats, and other kindred vermin. To Edward they conveyed no sense of being vermin, and his pinafore was full of such a miscellaneous litter as he could pick up, and these he would take home and deposit in drawers and cupboards, to the horror of his father and mother, who had the clearing out of these nests on numerous occasions. For these tricks he was scolded and beaten, but neither seemed to produce any effect upon him. If he was set to rock the cradle of the baby who came after him, he would wait until his mother's back was turned, and then off would start on his wanderings, generally dragging any willing boy or boys whom he could find to accompany him. He became so troublesome as a wanderer, that his father determined that he would one day take his clothes with him to the factory. His mother had to go out for milk, and previous to doing so had pinned a red flannel petticoat round his neck. No sooner was she out of the

house, than he dodged her and away he started for his old haunts. When his father came home, great was his surprise to learn that he had disappeared in the morning, and had not been seen again by his mother during the day. Very angry was the father. By-and-bye a neighbour came in and said that the lad had returned, and was warming himself at her fireside. Tom had, however, very soon followed her, and heard most of his father's threats of what he would do for him. The woman, however, got a promise that he should "no' be licked," and at this the lad came forward. Immediately the father caught sight of the petticoat hanging loosely around his neck, covered with mud, and his legs and arms in a like predicament, he burst into a loud fit of laughter. That ramble brought on a serious fever, from which it was months before he recovered. During this fever he talked much of his beasties, and his first sensible words were, "Mother, where are my crabs and bandies that I brocht hame last nicht?"

A number of boys out in the woods one day noticed hanging to a branch of a tree, a bees' "byke," or nest. None of them dared venture up the tree to try and get it, but Edward, with more boldness than the rest, climbed it and found when he got near the byke, that his Scotch bonnet would not be large enough, neither would his stocking, and, as nothing else appeared available, he took off his shirt, and, after being severely stung, he managed to get it safely into his nether garment, and folding it up tightly, started for home. He arrived safely there, and deposited his treasure in an old iron porridge kettle, and attempted to steal quietly

into bed. His younger brother noticed the absence of the shirt, and shouted out to their parents. Up the stairs came father and mother, and on the appearance of the strap of which he had often made acquaintance, he confessed where his shirt was to be found, and offered to go and fetch it for his father to show him that there really was something peculiar about it. The father declined this proof, and they poured some boiling water on it. In the morning they found that what master Tam had really brought home was—a wasps' nest.

Schooldays came on, and he was sent to a dame's school to be out of the way, and here he became a dreadful truant. The help of his grandmother was called in to take him to school, and this she did day after day, but he would trick her in a number of ways that he became the bane of the poor old woman's life. One day she had followed him on one of these truant excursions, down to the Denburn, a little distance from Aberdeen. Here he was searching for horse-leeches, and while he was in the act of getting one of these, he saw his grandmother's form reflected in the water, and at once dropped the stone which he was lifting up, and off he started as fast as his legs would carry him. The poor old lady made a clutch at him, but missed her footing, and fell headlong into the water. The dame who kept the school, if she did not teach her little folks much, had at least the merit of possessing much Scotch piety. She prayed with the children twice a day. Young Edward became a perfect dread to her. His pockets were perpetually full of all kinds of live stock, and time after time, he got his ears boxed whilst he

was emptying them at the nearest safe place. But all the corporal punishment which he ever received, did not deter him from following the bent of his inclinations, and he became not a whit better. The more he was punished at home, and scolded at school, the more he visited his favourite haunts.

One day, he took with him to the dame's school a jackdaw, which became very fond of him, and he of it. His mother had become tired of its noise at home. He received strict injunctions to get rid of it, and what to do with it he did not know. At last he hit upon the plan of lodging it in his baggy trousers, and so went into the room where the school was held. During the time the scholars were on their knees, the jackdaw had struggled to get its head out between the top of the lad's trousers and his vest, and then commenced its peculiar noise, startling the old dame out of her wits. In answer to her hurried questions as to what it was, she was informed that it was "a beast of Tam Edward's," and the youngster was seized by the coat collar, and carried bodily out of the room, and deposited safely into the street. The old dame had had quite enough of young Edward, and that was the last of his first experiences at school. Edward was not more fortunate at his second school. He was very soon ignominiously dismissed for taking horse-leeches in broken bottles.

A third school was found for him, but there seemed to be a dreadful fate hanging over the youngster. His reputation for carrying beasts about with him had spread to every school in the district, and this bad name clung dreadfully to him. On a hot summer's day, one

of the masters received a dreadful bite from a centipede. Nobody in the school would acknowledge to having brought it there, and young Edward was called up.

He was asked, did he bring it, and his reply was "No." This so enraged the master, who was suffering from the bite, that he gave him a double punishment, one for bringing it, and the other for telling a lie. Even after this severe beating with a strap, he persisted in saying that he had not taken it there, and after each relay of whacks, the master only seemed to lose his temper the more. Edward's back and hands received at this time the worst punishment of any of the many inflictions of this nature with which he had been visited. Out of breath, the master finally took him by the collar, and thrust him forcibly out of the school. Towards nightfall, Edward went home, and at night his father intended to give him a second edition of what he had received at school, but it was found that his shirt could not be taken off, owing to blood having flowed from the cuts, and clotted. Go back to that school he would not, and he has said in after life, that his statement about having taken the centipede was perfectly true.

He was too young to go to work, and so for some time he could do pretty well as he chose, and he took every advantage of doing so. His school became the seabeach and the little rivulets which ran into the sea. On one of these wandering expeditions he had a singular adventure. While searching among the heather and stones for specimens of natural history, he caught sight of a peculiar animal. He lost sight of it, and

began to tear up the heather, and as he rested for a time, another lad came up and asked, "Fad are ye looking for?"

"A thing like an eel," he replied; "will ye come and help me?" "Na, na!" said the lad; "I dinna want to be bitten to death; but I ken that what ye are looking for is among that heap o' stanes there."

Away went Edward, and commenced lifting off the stones one by one, but no eel did he see. In despair, he turned over a heap of turf which was near, and there was the ugly creature he had been long in search of. Down he pounced on it in a moment with both hands, and grasped it tight. Away he started home and ran in to his mother with the thing wriggling in his hands, saying, "See, see, mither, what a bonnie beastie!" Away she fled, and some neighbours after her, with the cry of "A snake!" "A snake!" He was told to take it to Doctor Ferguson, a chemist near, and there he went, followed by a number of boys, who kept, however, at a very respectful distance. When the doctor saw it, he ordered the boy out of the shop, and told him to stand in the middle of the street until he had got a bottle. This was soon found, and he was told to put it in there and cork it up at once. He did so safely, and then received from the chemist foupencee for the biggest adder which had ever been seen in the whole country.

He was fast acquiring idle habits, and the parents began to think what trade he could be placed at, and although only six years old he went to work at a tobacco factory for fourteempence per week. He did not stay long here, for he had heard that at one of the factories some

few miles from where they were living, the boys earned more, so after a good deal of persuasion he was allowed to go. In order to get his breakfast, and be at the mill at the proper time, he had to be up by four in the morning, and rarely got home before nine. His way from their home lay partially through thickly-wooded fields, and partially by the side of a burn or brook. These in the summer time were very pleasant, but in the winter bleak and uninviting. Years afterwards, when relating the facts connected with his life, to Dr. Samuel Smiles, who has given us such an interesting account of this self-made naturalist, he said, "People may say of factories what they please, but I liked this factory. It was a happy time for me whilst I remained there. It was situated in the centre of a beautiful valley, almost embowered amongst tall and luxuriant hedges of hawthorn, with watercourses and shadowy trees between, and large woods and plantations beyond. It teemed with nature, and natural objects. The woods were easy of access during our meal-hours. What lots of nests! What insects, wild flowers, and plants, the like of which I had never seen before! Prominent amongst was the Scottish nightingale, which lay concealed in the reedy copses, or by the margin of the mill-lades. Oh! how I wondered at the little thing; how it contrived to imitate almost all the other birds I had ever heard, and none to greater perfection than the chirrup of my old and special favourite, the sparrow! It so happened that for a month or two during the summer-time, owing to the scarcity of water, one part of the factory worked during the night-time and the other during the daytime,

week and week about. This was a glorious time for me. I rejoiced particularly in the night-work. We got out at six in the morning, and, instead of going directly home, I used to go up to the woods of Scotston and Scotston Moor, scoured the country round them, and then returned home by the auld brig." "Ah, these were happy days. There were no taws (strap) to fear, and no tyrannical dominie to lay them on. True, the farm people did halloo at me at times, but I generally showed them a clean pair of heels. The gamekeepers, also, sometimes gave me chase, but I managed to outstrip them; and although no nests were to be got, there was always something to be found or seen." . . . "This was life, genuine life, for the young. But, alas! a sad change was about to come; and it came very soon."

After working for about two years at the factory, the father thought that the time had arrived when his two eldest sons should be apprenticed to some regular trade, and he fixed upon that of shoemaking. He was forthwith bound for six years to a shoemaker in the Gallowgate, Aberdeen, where his wages were to be eighteenpence per week, for the first year, and rising sixpence a week afterwards. Cobbling and tipping have for years gone together, and so it appeared to be the case with Begg, the name of the man to whom Edward was apprenticed. He was dissolute, irregular, and quarrelsome in his habits, and when drink was in him, not only wit, but "the milk of human kindness" was out of him. He was in many respects a typical representative of the kind of masters to whom boys

were apprenticed years ago, and the youth of to-day have much to be thankful for, that a new species of masters has originated who dare not practise cruelty, and who must teach the trade to which the apprentice is bound to him.

Edward very frequently would take with him to the shop little boxes containing butterflies, or bird's eggs, which he had found on his way to work, but Begg soon got into a habit of rifling the lad's pockets of such things, and pitched them into the street, boxing afterwards Edward's ears for being "such a fool as to care for such varmin." Tom's pets were ruthlessly treated by Begg, and this cruel treatment of the little things hurt Edward a great deal more than the physical punishment which he was constantly receiving.

One day Edward took three moles to the shop, and these Begg killed at once, and afterwards knocked down Edward with a last, and then seized him by the neck and breast and threw him into the street. At last he protested that he would not go any more to work for such a cruel master.

Thoughts came into his head of going for a sailor, and he eventually came to the conclusion to run away from home. He had no money of his own, as all that he had been able to earn had been given to his mother. His mother went out for a longer time than usual one day, and, finding sixpence, he bundled his few things together and started off, with the idea of going to Kettle, about a hundred miles distant from Aberdeen. He walked forty miles on the first day, and slept at night on some hay which he pulled from a rick. He

reached Kettle, but his uncle did not by any means give him a warm reception. This rather chilled him, and for the first time he began to think what his father and mother would say of his disappearance. The next day he started for home again, his uncle having supplied him with eighteenpence to pay for food and the crossing of the ferry at Dundee. He reached home again without anything more serious happening than a near chance of being tossed by a bull, and got nothing worse than a severe lecture. He begged to be allowed to go to sea, but this his father and mother would not hear of, and so he resumed his shoemaking, but this time under another master, who had a kind disposition, and as Edward did not neglect his work during his master's time, he was allowed to follow the bent of his inclination, and of these opportunities he made the most use.

His parents about this time had removed to another house, and adjoining this was a piece of waste ground. He now commenced what he termed his Wild Botanical Garden. Here he tried to raise the wild flowers which he gathered during his rambles. Some of them grew pretty well, but others of them withered and died. His mother suggested the making of an ordinary garden of it, and, adopting this plan, he visited frequently a heap where the gardeners, at several large houses outside Aberdeen, were accustomed to throw away roots which they did not want, and from this Edward obtained sufficient to make a neat and well-stocked garden. He made a habit of never planting more than one flower, so that in course of time he had quite a rich variety.

Time passed on pleasantly with him for a little time. He improved his knowledge of reading by reading the prints which were exhibited on the stalls which attended the market, and spent his spare pennies in the purchasing of the *Penny Magazine* and other periodicals. Trade afterwards became very bad, and Aberdeen shared in the universal depression which was then experienced. Many people left England and Scotland and emigrated to the United States, and Edward would have done this if he could have raised money enough for the purpose, and, failing this, he made a strong effort to get out as a stowaway, but was discovered in his hiding-place just as the vessel was about to sail, and so had to give up the plan.

In 1831 he enlisted in the Aberdeenshire Militia, at which time he was eighteen. One day the regiment to which he belonged was out for drill on the sea-shore. The afternoon was bright and warm, and there came flying in the neighbourhood of where the men were standing a butterfly. Edward caught sight of this, and no sooner did he do so than off he started to catch it, and flew in and out of the small sand-hills, making energetic clutches at it as he ran along. What a chase he had! and what a chase the corporal of the company had too, to catch Edward; but he presently did so, and laid hold of him roughly by the neck. Back he was marched, and the corporal had instructions to lodge him in the guard-house for breaking away from the ranks during drill, as butterfly-catching was scarcely considered a part of military training. Two militiamen walked in front of him and two behind, and he was

brought before the officer, who asked him: "Well, sir, what have you to say about breaking the ranks during drill, and running after a butterfly? Are you subject to fits of insanity?" To this Edward did not reply, and the officer asked again: "What induced you to leave the ranks and run after a harmless insect?" His reply was: "I really do not know, unless it was from a desire to possess the butterfly." He had never been insubordinate before, and as some ladies who had noticed the occurrence, interceded for the poor fellow, he received nothing worse than a reprimand.

Edward, shortly afterwards, at the age of twenty, moved to Banff, in which town, with only a short period when he was in Aberdeen, he has resided the remainder of his life, and where he continues to live to-day. He had no love for his trade, shoemaking, but it appeared the only trade by which he was likely to earn a living. His bench was rarely ever free from caterpillars or other insects, and from these old habits of his his shopmates were just as much annoyed as had been the children and masters of the schools of his childhood. At the age of twenty-three he acquired another passion, and that was for a servant at a farmhouse, and they had the courage to marry when Edward's earnings averaged some nine-and-sixpence per week, but in his wife he had found a kindly and sympathetic companion, and Edward has acknowledged in a very touching way how cheerfully his dear wife bore up amidst their poverty and Edward's love of his favourite pursuits. He had learned how to preserve and stuff animals and insects, and his house—for he

had taken a little cottage—was soon full of these treasures. It was now that he began very seriously to feel the disadvantage of being able to read and write only with difficulty. Arithmetic was an unknown subject to him. He had never up to this time read a book on Natural History, so that all the knowledge of the various insects and animals he had gathered was his own discovering. He was looked upon by those with whom he worked as queer and uncanny. Drink was the pleasure of his shopmates, but he had no dissipation of this kind to indulge in. He was of a thoughtful and retiring disposition. His love of nature intensified, and to use his own words: “I can never succeed in describing my unbounded admiration of the works of the Almighty; not only the wonderful works which we ourselves see upon earth, but those wondrous and countless millions of orbs which roll, both near and far, in the endless immensity of space, the Home of Eternity! Every living thing that moves or lives, everything that grows, everything created or formed by the hand or the will of the Omnipotent, has such a fascinating charm for me, and sends such a thrill of pleasure through my whole frame, that to describe my feelings is utterly impossible.”

At the age of twenty-four, and after he had been one year married, Edward commenced in real earnest to make a collection of natural history objects. His apparatus was of the rudest description. Bottles, nets, and boxes for his insects were all of his own adapting, and such as he could make or procure without much expense, as he had neither money nor time to waste.

Night after night, in the spring and summer-time, after he had been working hard at his bench during the day, he would snatch a hasty supper of cheese and bread, and then he would start on his rambles, taking with him, besides the things named above, an old rusty gun, with the barrel tied to the stock with stout twine, and spend the nights out of doors, resting often, during the hours of darkness, under a favourite gravestone in the Boyndie churchyard, near Banff. He was a perfect conundrum to his neighbours. They could not bring themselves to give him the poacher, but they were mystified at his nightly excursions and odd habits.

In addition to making his miscellaneous collection, he grew quite a capital taxidermist, and could produce some good specimens of stuffed birds, rats, and other animals which came in his way. One of the receptacles in which he would place his "takings" was his hat, and this used to be full on these nocturnal wanderings of a very "olla podrida" of insects, birds, and other specimens of natural history. He could not, of course, go out on these visits night after night without meeting with some adventures, and these he very frequently met with. He received many bites from weasels and rats, and on one occasion he was very near being injured by several badgers. One adventure with a pole-cat I may mention. He was lying out of doors near to the ruined castle of the Boyne, a favourite haunt of his, above five miles west of Banff. He was awakened from his sleep by a patting about his legs. He thought it was a rabbit or a rat, and moved his legs sharply, and so thought he would get rid of it. The animal would not, however,

go, and he gave a rapid dash with his hand, and there was a shriek as it fell to the ground, and then he knew at once that it was a pole-cat. On recovering itself it flew at him furiously, and attempted to get at a water-hen which he had in his breast. The pole-cat screamed and clawed at him, and Edward's grip did not appear to be a very sure one, but he eventually gained the mastery by making it swallow about an ounce of chloroform, a commodity which he always carried with him on these excursions, and then he was able to get it down on the ground and place his foot on its neck. He says of this encounter that it was the most terrible that he ever had with an animal of its class. His hands were very much bitten and scratched, and for a long time afterwards remained sore and inflamed; but he states that the pole-cat which he had captured was well worth the struggle. It was a male which he had caught, and he afterwards stuffed it as a companion to a female which he had at home.

These nightly visits of his made him familiar with the birds and animals which catch their prey in the darkness, but, in addition to this, he learned much of bird life.

He became anxious to form a natural history collection, and he had many dreams of what might be its ultimate usefulness to himself and to others. He greatly felt the need of a friendly hand to guide him, and to save him from having to struggle through many difficulties which, had he been able to obtain books and practical help, would have aided him materially, and saved him much time and laborious work. He was

most assiduous in his labours. If he wanted to procure a particular bird or insect he would walk miles, and search patiently for days until he discovered that for which he was looking. He fixed a number of traps in all sorts of places, composed of dead birds, rats, rabbits, hedgehogs, fish, crabs, or seaweed, and these he placed in all sorts of out-of-the-way corners, and visited some of them daily, others weekly and monthly. By dint of his perseverance he had collected over nine hundred specimens of insects, and these he had pinned down in boxes of his own making, and placed numbers to them which he had cut out of an old almanack. There were twenty boxes in all, and these he had ready for glazing. They had been deposited in a garret for safety, and after he had obtained the glass he went up to the room to get them, when, to his great astonishment, he discovered that the box had been stripped entirely of its contents. On looking at the others, all had been served the same, except a wing here and a head there. Rats or mice had evidently got at them. His wife asked him what he was going to do next: "Weel," said he, "it's an awfu' disappointment, but I think the best thing will be to set to work and fill them again." This he did, although to collect these 916 insects he had been four years engaged.

Sir Isaac Newton setting to work again after his favourite dog "Diamond" had overturned a candle, which had set fire to some papers upon which were mathematical calculations, which had occupied him for years, did not show a more noble spirit than did Edward, who, without delay, began again collecting

moths and other insects, and in about three years he had replaced his lost number. He had now been some eight years collecting, and during this time—1845—he had preserved nearly 2,000 specimens of living creatures found in the neighbourhood of Banff. About half the number consisted of quadrupeds, birds, reptiles, fishes, crustacea, starfish, zoophytes, corals, sponges, and other objects. In addition to these, he had also collected an immense number of plants. His cases were entirely his own making, and the papering of them inside, painting outside, and glazing was also his work. His collection filled no less than 300 cases, and every nook and corner of his house was full of them.

It had long been the wish of his heart to leave the shoe-making trade, and give his attention wholly to natural history. He had a project of exhibiting his collection, and this he did at a hiring fair in Banff in 1845. A great many country people visited the town at this fair, and there was always at it a miscellaneous collection of fat women and dwarfs, and other wonderful things, and he thought that surely among all these curiosities there would be many who would pay the small entrance sum to see the contents of his cases. A room in the Trades' Hall was taken, and it was advertised as a "Collection of preserved animals, comprising quadrupeds, birds, fishes, insects, shells, eggs, and other curiosities."

One of the local papers said of it, "that the collection was the result of his own untiring efforts and ingenuity, without aid, and under discouraging circumstances, which few would have successfully encountered. . . ."

Our young friends especially should visit the collection ; it will both amuse and instruct them. They will learn more from seeing them in half-an-hour, than from reading about them in half-a-year."

His neighbours were greatly surprised, and some of the better class enquired as to "what had made him a naturalist?" Edward says that "when this question was first asked him he was completely dumbfounded. I had no notion that a naturalist could be made. What ! make a naturalist as you would make a tradesman ! I could not believe that people became naturalists from pecuniary motives. My answer to those who put the question invariably was, and still is, I cannot tell. I never knew of any external circumstance that had anything to do with engendering in my mind the never-ceasing love which I entertained for the universal works of the Almighty ; so that the real cause must be looked for elsewhere."

The exhibition was a success, and Edward was greatly encouraged, and at once set to work collecting for another exhibition, which must be larger and more comprehensive than the first, but he decided that Banff was scarcely the place for this, and he fixed upon Aberdeen as being the city where he would be likely to have most visitors. He was buoyed up with this great project, which filled his thoughts night and day, and he was most assiduous in adding to his collection every specimen of interest which came in his way. He had been successful at Banff, surely he would meet with far greater encouragement in a large and well-populated city like Aberdeen, with its university, its many

schools, and its reputed learning. It was natural that he should feel very enthusiastic about this project, and long before the time came for him to think of moving his collection to the granite city, he had planned what works on Natural History he would be able to buy with the proceeds of his exhibition, and that he would also be able to obtain a microscope for a more minute study of some of his specimens. Aberdeen was to be to him a veritable El Dorado, and no one can say that this young man, who had in the spare moments saved out of his labours as a shoemaker, should anticipate that this venture of his would place him in such a position that he would be able to devote the whole of his time to the pursuit of the natural history studies which had become a very necessity of his existence. It was not that he had a soul above his shoe-soles, for it is a very interesting fact that Edward was acknowledged to be about the best workman which his employer had, and was always entrusted with work to which special attention was needed. His promises with regard to the time that certain work were very different from the majority of the promises of shoemakers in general, for he could always be depended upon.

The British Isles provide very numerous examples of young men who have struggled manfully and nobly, toiling diligently in the honest, if humble, calling which they have followed for a livelihood, yet given to burning midnight oil in the acquiring of knowledge, or following patiently a certain bent of study, overcoming difficulties by which thousands around would have been baffled and defeated. Among this great number

we may certainly include Thomas Edward, and I should like to dwell on this portion of his life. When in Aberdeen he fondly hoped and expected he would meet with some appreciation of his collection, and enough money to permit of his henceforward looking to natural history to find bread for himself and family. To him it was drawing near the Rubicon, and the future was full of promise, for were not the Aberdonians about to come in hundreds, and pay their money to see what it had taken him years to collect?

Edward had taken a shop in Union Street, which is now one of the finest thoroughfares in Great Britain, and on a Friday, in July, 1846, the six large carriers' carts, containing his collection, and also the furniture of their little cottage. His patient and helpful wife, with their five children, accompanied the carts, and so they in this way performed the journey to Aberdeen by road, at which place they safely arrived.

He at once got them in order, and issued his handbills and advertisements. One of the handbills stated that "the objects comprising this collection have been collected in the counties of Banff and Aberdeen, and preserved by a single individual, and that individual a journeyman shoemaker. They have been exhibited by him in Banff, to the delight and admiration of every visitor—all being surprised at the beauty, order, and multitude of the various objects—some going so far as to doubt the fact of the proprietor being a shoemaker, saying that it was impossible for a person of that trade being able to do anything like what they saw before them.

“Thomas Edward takes the liberty of stating that the collection is allowed by eminent naturalists to be one of the greatest curiosities ever offered for public inspection in this quarter, amounting, as it does, to about two thousand objects; and being the work of one individual, who had to labour under every disadvantage, having none to tell how or where to find the different objects; none to teach him how to preserve these objects when found; no sound of promised reward ringing in his ears to urge him on his singular course; no friend to accompany him in his nightly wanderings; help from none, but solely dependent on his own humble abilities and limited resources.”

Such was the appeal made to the Aberdeen public, helped on by kindly notices in the local papers. The prices of admission were low enough for all, being, “Ladies and gentlemen, 6d.; tradespeople, 3d.; children, half-price.”

After all was ready for the crowd, which he fondly thought would gather at the door, he looked around his eight years' collection with a pardonable pride. He thought he had reached the Rubicon and was just on the threshold of better and more prosperous days. The Aberdeen public little thought of how their sixpences would have helped to cheer that worthy soul, but they were very very chary of parting with them.

Sad to say, there were very few who came to see it. Some of Edward's chief visitors, those who had stuffed birds and animals to sell, or others who mistook him for a dog doctor and wanted cures for pets of the canine tribe. He was told by several professors of the Aber-

deen college that his collection was one of the finest which they had ever seen ; but, Job's comforters as they were, they generously informed him that "he was several centuries too soon, as the people of Aberdeen were not yet prepared for such an exhibition, especially as it had been the work of a poor man."

True, he was a "poor man," but possessed a noble heart and an indomitable perseverance. Poor fellow! disappointment, bankrupt hopes, ruin looked him in the face. He had faith in himself, but he had fears that it was as the University professor had said,—he was born a century too soon. There were not a few of his visitors who had the impertinence to doubt, and that in no choice language to him, that the collection had really not been got together in the way he would have people believe.

This he felt very keenly. A few of the people came to see his exhibition who worked at the mills where twenty years before he himself had been as a lad earning a pittance to aid his father and mother in providing food for themselves and their bairns. He naturally thought that the labouring class, of which he was one, and among whom he had lived, would take some interest in his exhibition ; but no, as the days of its being opened increased in number, the attendance appeared to decrease. He advertised and distributed handbills in thousands, but the result was still the same, although he had reduced the price of admission to a penny for the working classes.

The rent of the shop he had taken was falling due at the end of the third week, and he was deeply in debt, a feeling which chafed him into an agony of mind. Each

day only seemed to drive him deeper into the difficulty. He had risked his all in the undertaking, and he could see nothing but absolute ruin for him. Black despondency seized him, and in the midst of his bewilderment no wonder that his reason for the time being should have been unhinged. Wife and five children dependent on him, his situation to be lost unless he returned without a day's delay, debt, and nothing to pay with, all helped to bring on a state of feeling which would have tried the strongest will. He went out with the intention of not coming back again, and made his way to the seashore. He had taken off his hat, coat and vest, and remained looking into space with an utter blankness of mind, until suddenly his eye caught sight of a flock of birds, and among them one which was different from all the rest. He waited until they rested on the sand, and then off he started towards them. Each time they rose and flew away off he started too, for his curiosity to know something of the strange bird among the flock was thoroughly aroused; but secure it he could not, but one thing he did secure, for to-day he is alive and could tell the story of how his life was providentially preserved by a little bird and his intense love of nature.

It was hard to bring himself to the fact that his collection must be sold, but go it must. Several gentlemen spoke of its being preserved by one of the scientific societies, but nobody was ready to advance the necessary money, and eventually it was sold for twenty pounds ten shillings for the use of a boy who never seems to have made any use of it. His heart went with it, and,

broken in spirit and desolate in heart, he returned to Banff. The walls of his cottage which, before he left had been hid completely with his cases, now only presented a bare appearance, which chafed and depressed him. Hunger, which is a hard master, left him no time to grieve long over his lost collection and his almost penniless condition, for the twenty pounds had all been absorbed in paying his debt, an undertaking which he gave himself no rest until it was accomplished. So little had he left, that there was not sufficient to pay the carrier for the bringing of the wife and bairns back to Banff, but the kindness of the carrier who had taken them to Aberdeen helped them to overcome that difficulty by taking them without charge.

His disappointment was keen. The cup of fortune had been dashed from his lips just as he was about to raise it to his lips, but, like all noble natures, he did not give way to repining and quarrelling with his fate. Without delay, he returned again to his shoemaker's bench, and whacked the leather even more briskly than ever he had done before.

The brave wife, who had cheered and stood by him through all his cares, showed at this time what a true helpmeet she was. The house became comfortable again, and around his fireside, with the little ones bearing his name and the brightness of his wife's face, he soon resumed his usual manner. An autumn and winter passed, but he did not do much to replace his lost treasures, but immediately spring returned his old habits came back upon him, and he could not, had he tried, overcome the irrepressible desire to make another

collection. For nights together he would be away after his day's work was over, and would stay out on the moors and in the fields, ready again to commence his searches with the first streak of dawn. His clothing possessed wonderful receptacles for his boxes to contain specimens which he found. His coat was all pockets, both inside and out, and his waistcoat had been specially made by his wife, also, with pockets in such places as had never before been dreamed of, and even his hat had been constructed for a similar purpose. It had a deep crown, and just above the portion for his head there was a partition for lodging specimens. He was perfectly contented when he was out hunting in this way. Very often, hungry and footsore, he would return home in the morning, and as soon as he had finished his breakfast off he would go to work.

One day he had wandered farther away than usual, and in rather a new district to him. He was out on a moor, and had been utterly unconscious that a storm was approaching, and before he was aware it burst, and there he was, on a wild moor, without a house or any place of shelter in sight. He had his pockets full of chip-boxes, which contained specimens in abundance of ants, butterflies, moths, worms, and other things, for he was out on a three days' excursion, it being a holiday time, and there was no leaving his specimens behind "until called for." The rain came on in torrents, and he was soon drenched. He ran first along one path, then in another, but no house was to be seen. It was a perfect hurricane of rain, such as only the Swiss and the Scotch mountains can provide. On he ran, until at last

he espied some smoke issuing out of a thatched roof, and for this highland cottage, arriving suddenly, to the consternation of two little girls who stood at the turf fire, and dropped on the nearest chair, without for a few minutes being able to speak. The mother was out, but the girls said that he might remain, and he presently began to see in what condition his cardboard boxes and the inmates were.

The two girls evidently found something very amusing about him, for they laughed away heartily, looking at him as they did so. Then off they scampered to fetch their mother, who was out some distance cutting firewood. Presently she came with an axe in one hand and a stout branch from a tree in the other, and looked sternly at Edward, in such a way that he was not quite sure which she was going to use on him first. "Will ye' gang, ye varmin?" she kept repeating, Edward protesting meanwhile that she was wrong; but, poor fellow, he very soon found out that she wasn't, for crawling all about him were caterpillars, moths, and butterflies, and other live-stock in a half-drowned condition, but in such a way that he was literally all alive. He strode rapidly away to an outhouse and overhauled all his clothes, and then came back to thank the woman—standing at a respectful distance, for she would not let him come near her or enter her house again—for the shelter which she had given him.

Edward had much cheap advice given him as soon as his exhibition at Banff brought himself and his hobby into notice. There is always more than enough of this stale commodity to be had cheap, but practical help he

had none from his townsmen or others who had come to know of his work. Some advised him to extend his researches into Aberdeenshire, and others to contribute specimens to general museums and so bring his name into prominence, but publicity he knew well would never feed and clothe his eight children. His bravest helper was his wife, and her practical aid was worth a book full of such prolific advice as was being constantly tendered him. She worked at the uppers of the boots, of which Edward placed on the soles, and she worked too for others and so earned wages in this way; but with money so coming to her she very frequently bought boxes for his insects or wood for his cases.

No wonder, then, that Dr. Smiles, in his book, should pay the tenderest tribute to her memory. She possessed the truest nobility of heart and soul, and never regretted joining her lot with Edward, and commencing their married life on eight shillings a week.

A friendly magistrate gave Edward a kind of pass which enabled him to wander about through fields as his fancy led him, with his gun and his pouches, without being taken for a poacher; and this was of considerable service to him in preventing disagreeable interviews between himself and farmers, who could not understand a man running about to pick up livestock as it came in his way.

It was scarcely possible for him to wander far and near in this way without meeting with adventures and without, at times, serious risk of life and limb. He was one day out among the precipitous rocks of the sea-coast, and shot at a marten flying over his head. The bird

fell, but he could not make out where it had dropped down. In searching for it he had to climb the cliff, and in doing so missed his footing and fell down a distance of some forty feet. His gun had preceded him and had become wedged between two rocks, and he fell on it, breaking it to pieces; but it broke his fall and probably saved his life. He fell into two clefts of the rock, and the weight of his body and the force of the fall made it impossible for him to get out by himself. Two ploughmen, who had been watching him from a distant field, came to his assistance. Had it not been for them it would have gone very hard with Edward. This accident cost him a fortnight's loss of work. No bones were broken, but he was very sore, and had sustained some severe contusions.

Nor was this the only occasion when his life was in real danger of being sacrificed to his love of nature, but this did not deter him from still going on in his researches.

A Rev. Mr. Smith, Presbyterian minister in the neighbourhood, was one of the warmest and best friends that Edward ever had. He advised him to write down on paper all that he knew or could learn about the specimens which he acquired, and this, after a good deal of persuasion, he did, and afterwards communicated to a local paper short but most interesting sketches, some of which displayed a quickness of perception and a felicity of expression which was really most remarkable, considering how little education he had received. His description of birds and their habits was most graphic. In the preparing of these papers

for press Mr. Smith gave him the most practical assistance, taking the notes of Edward's observations, and, at a later date, persuading him to let him send the communications to the *Zoologist*, in which they afterwards appeared. Did space permit, many of these descriptions of birds would be of considerable interest; but I must refer the reader to the book of Dr. Smiles' "Life of a Scotch Naturalist," who has, in this life of Thomas Edward, given us one of his most charming industrial biographies. This work of Dr. Smiles was to him a labour of love, and it is from it that most of the facts which I have quoted are collated. All who desire a fuller account of this shoemaker naturalist should read the book referred to, which has now been published in a cheaper edition.

The closeness of observation, the accuracy of his views respecting birds and bird life, were amazing to those who came in contact with him. His patience was astounding; nothing ever seemed to give him the sense of weariness and fatigue when he was on the search for specimens—and that meant every time he was out of doors. In a letter to his biographer he said, "In looking over my printed articles you will find a great number of notices of the habits and workings of various species. I spent so much time in observation, that I had little time to spare to write out the results, and what I did write, did not seem to be much appreciated. Perhaps this is not to be wondered at. It appears that the compilers of works on natural history in this country do not care for details of the habits of the animals they treat of; they rather glory in the abundance of technical

descriptions they can supply. These may seem scientific, but they are at the same time very dry. In fact, natural history is rendered detestable to general readers. We want some writers of the Audubon and Wilson class to render natural history accessible to the public at large."

Edward was perfectly right in this, and, had he only received a complete education, there is no doubt but he would have been one of those who would help materially in expunging difficult words and phrases from such books. It is, in fact, due to the lives of such men as Edward that books have since been written of a simpler and more popular character.

Another Presbyterian minister was also of considerable service to him. His house was always open to Edward, and a friendship of the warmest character existed between them, and continued until the time of Mr. Boyd's death, in 1854. He interested himself greatly on Edward's behalf, and not long before his death he, in conjunction with some other gentlemen, who were on a visit to his house, had a long notice inserted in a Fraserburgh paper; portions ran as follows:—"During the past month our district has been visited by Mr. Thomas Edward, from Banff, a naturalist of no mean attainments, and one who, we doubt not, will soon bring himself into public notice, both by his indefatigable researches into natural science, and his valuable contributions to various scientific periodicals. . . . We cordially wish Mr. Edward every success in the various fields of research upon which he has entered. It is but justice to a most deserving person to draw attention to his praiseworthy

endeavours, in the midst of many difficulties, to perfect his knowledge of natural history, and to recommend it to all around him, especially the young. Happy would it be, if our tradesmen were to take a leaf out of Mr. Edward's book, and instead of wasting their time, squandering their means, and embittering their existence in the haunts of dissipation, they would sally forth in these calm summer evenings to rural scenes and sylvan solitudes, to woo nature in her mildest aspect, to learn a lesson from the moth or the spider, to listen to the hum of the bee or the song of birds, to mark the various habits and instincts of animals, and thus to enrich their minds with useful and entertaining knowledge."

The idea underlying this notice was to get the working classes interested in natural history, and to arrange with Edward for some lectures of a rudimentary character; but Mr. Boyd's sudden death put an end to this, and Edward grieved for him sorely, as a true friend gone from his side.

Several friends interested themselves on his behalf. He was willing to undertake any kind of honest work which would bring him in a livelihood for his wife and family; but apparently there was nothing likely to prove a permanency which would take him away from his cobbler's bench. Even for his many articles in various scientific periodicals he received no remuneration, although some of them were of a valuable character.

From many of these it would be easy to quote at length, and there is in them much original and suggestive information of fishes, crustacea, zoophytes, molluscs, fossils, and plants.

It was scarcely possible that so many nights spent out of doors in all kinds of weather should not have some serious effect on his health, and this now gave way. A severe attack of rheumatic fever seized him, and for four weeks, and for the greater part of this time he was wandering about his insects and birds. The doctor told him that if he wished to have his life preserved, he would have to cease entirely from his nightly excursions. His earnings had been so small that he had been able to save only very little ; but, as on previous occasions, his chief savings bank—the collection of natural history—was the means by which he was once again cleared from debt, and was scattered among purchasers.

He had been obliged to take very seriously to heart what the doctor had said, and although he was forbidden to go out and spend nights in the open air, he was determined not to give up his studies immediately his strength returned, and he was able to follow his daily employment. In his spare time, which he always made for nature, he began to devote himself to the natural history of the sea-shore, and in this department of study he was very successful in discovering a number of new specimens not previously known.

Several of his daughters were exceedingly useful to him in this work, for they would go among the fishermen as they brought their night's catch to market, and obtain the rubbish out of their nets, for which they did not care. This so-called rubbish he obtained some very valuable specimens of crustacea. Both he and his family soon became well known to the fishermen, and

he was helped greatly by several of them. On one occasion he wrote as follows to the local paper, which now regularly printed his notes on the specimens which came in his way: "It is quite astonishing what amazing numbers of minute creatures are at times to be found amongst the refuse of only one boat's lines. . . . The ocean is, as it were, one vast and boundless expanse of life, and the inhabitants thereof about as numberless as the sands by the sea-shore. I have myself picked out of a net nine distinct species of shells, three different kinds of starfish, and five different sorts of zoophytes, besides worms, and a number of other parasitical animals."

It is impossible for me to follow up his studies of sea life in all its rich variety of forms. Friends at a distance began to lend him books, other naturalists named his specimens for him through the medium of the post, and one scientific gentleman sent him a microscope. Several again interested themselves in trying to procure for him work more congenial to his tastes, but these efforts, singularly and unfortunately, did not lead to the desired result. True, just about this time he became keeper of the Scientific Society's Museum at Banff, at a salary of forty-two shillings *per annum*, and all through his career the Banff public do not seem to have realized what sort of a man they had amongst them. It appears to have been the old story of a prophet having no honour in his own country. The scientific men of the district found it hard to swallow Edward's lapstone and his growing reputation as a naturalist. Get free, however, from his bench, he could not, and he has patiently and

submissively worked on at it up to old age, for to-day he is living and is at last honoured by his fellow-townsmen.

He corresponded with some of the most eminent scientists of the day, and many a naturalist who has added to our English literature on these important subjects, owes much to specimens which have been discovered by Edward, and especially to the information which he has been able to give of animal life.

His family reached eleven children, but although with his quiver full, he seems to have been greatly blessed, for all his children have grown up to love and to help the father, who has accomplished so much in the way of natural science, although so little of what the world often very erroneously counts success.

Edward was particularly enthusiastic in his discoveries amongst zoophytes, molluses, and fishes. These have for many years now occupied his attention. And in this department of study he was successful in rediscovering some specimens which had been completely lost to sight for nearly sixty years. At first so rare and unknown were some of his specimens, that there was a difficulty in naming them; but in this respect he was greatly aided by other naturalists, for there is a wonderful fraternity of feeling among lovers of nature, and there is often very much interchange of pleasant communication among them.

It was only natural that after all his correspondence with eminent naturalists, and the numerous specimens with which he had provided them, that he should receive some acknowledgment, and in 1866, he was elected as an Associate of the Linnæan Society, probably the

highest honour that could be conferred upon him. A diploma of the Glasgow Natural History Society was also granted him. It is a stigma on his townsmen that they allowed his humble but honest trade to stand between him and their regard for him. It would have been the greatest joy of his life to have been able to leave his bench and devote his remaining years entirely to natural history studies; but in 1877, and indeed afterwards, he was working away mending and making boots with as much zeal as he had shown in his young life.

His earnings have during all his life been but small; and in fact it may be said that all over Scotland wages do not reach the rates which are usually paid south of Tweed, for the reason I suppose that labour is more plentiful and few outlets for it. Notwithstanding the smallness of his earnings, he has always been able to save a little out of them, and this has always been spent in the pursuit of his natural history proclivities. It is an old but very true saying that true happiness lies not in the abundance, but in the fewness of a man's wants, and so the Scotch are in many respects greatly to be admired for their thrift, and the ease with which they adapt themselves to living on the narrowest possible income.

With all the educational privileges which the rising generation of this country enjoy, there is one most important principle which needs to be taught and learned over and over again, and that is, the dignity which attaches to all honest labour, no matter how low in the social grade the species of toil may be.

While Edward has naturally felt on many occasions

the wish that some employment congenial to his tastes might be provided for him, he has never, according to his own report, experienced any feeling of pride that he was above his awl and his lapstone; nay, rather on the contrary, the more he has advanced in his studies the better has his work been turned out as a shoemaker.

His sobriety has always been with him a strong point. While some of his fellow-workmen have idled their time and spent their earnings in drink, he has quietly and perseveringly followed his studies, achieving a success of greater practical worth than thousands of men who have had every facility for early education, followed by a university career.

The true value of natural history studies is well represented by Thomas Edward, and it is for this purpose that I have included his name in these sketches. Possessing no advantages of an early education; rarely, if ever, free from the anxieties which inevitably surround struggling circumstances, he has laboured on through every variety of trouble, but never relaxing, from his earliest years, his love for nature, which had become part of himself.

Such lives as his show the truest nobility of soul. In all his studies he has never lost sight of the great Author of the universe; and all natural history studies, unless they tend to this, must be very empty and unsatisfying in their results if they do not lead to an unquenchable admiration for the Creator of all things. Nay, the rather a mind imbued with these studies soon learns to stand in amazement at the wonderful forces displayed, yet the absolute perfection

of law and order. This awe becomes worship in itself, not from a fear of majesty and might, but from the feeling that an allwise Creator has indeed "ordered all things well."

In Edward's old age there may indeed be to him the consolation and assurance that his life and labours will be a source of strength to thousands who will come after him. He may have been born before his time, and, probably, were he thirty years younger, success in a worldly point of view would be his reward. The pioneer, however, must ever go before and perform the drudgery of preparing the way for others; and this is exactly what he has done, making the path easier, aiding most materially, with his specimens and his notes, those whose names have been more to the front, and who, in many cases, have reaped the honour which belonged to Edward.

I have already referred to Edward's wife and family. She, whose lot has been one with his, has cheered and bravely supported with an affectionate sympathy, which must have all through his married life been an unceasing comfort to him. His troop of girls have all been naturalists, and it could scarcely be otherwise, considering that every available part of their house has afforded space for his cases. They have also aided to maintain the household, and Edward owes much to the love which has lightened toil in his household.

As he nears the end of this life's journey, to enter into a more perfect rest, and maybe—who knows?—pursue his favourite studies in the great hereafter, we send to him, in his seventieth year, a warm and genuine

greeting, and with the wish, that around his latter years there may be much joy and a quiet, restful peace of mind.

I had recently a letter from Mr. Edward, and considering his age, and all through which he has gone, he writes a very firm and legible hand. He forwarded me with the letter, a copy of an address to farm servants, delivered by him in 1881. This address is full of sound advice, and I should like to give it in full, did space permit; but I can only give a short portion. He says:

“But your reading. Select good books together with history, travel, works on science and art, and all such like, biographies, and lives of eminent individuals. Peruse the last often and attentively, study the characters and traits of the various persons mentioned well and leisurely. Take lessons from, and imitate the best, that you may have a chance of becoming men. Surely it is for your own interests then that you join one or other of these institutions, and assist the promoters and your fellow-workmen all that lies in your power. I have heard it said by some of your own class that you have no means, nor any time for anything of the sort. Oh, no! Ye hae nae bawbees tae spare that wye, yer sma’ wages winna afford it, an’ yer maisters needs a’ yer time. Well, that looks plausible certainly. But what is the real fact? Listen, and if I am wrong, stop me.

“Have not many of you, I shall not say all, plenty of money to squander, which you do willingly, and with a lavish hand, when you like? Yes, when you like, and take time to do it too, whether it be your master’s or not. But on what is this money, this hard-

wrought for bawbees, and time spent? Shall I tell? Not on that which will either enlighten, elevate, nor yet in any way help to better your condition, No. But on that which rather tends to make you inebriates, and may lead you to—to what? Here I must pause, for who could take upon him to say what the end might be? The very thought makes me shudder. Beware then how you spend your money, and the precious moments you waste in doing so. Be not offended, I beseech you, at my seeming earnestness and pleadings; I wish none of you any harm, but rather good. I would be the same to all who waste their time and substance so, and who indulge in that doubly accursed thing—drink and lewd living.

“I will now advert a little to your time. Time wasted is time lost. Never forget that. Also that, once gone, it can never be recalled by you, by no one. No time, no means to get knowledge! No will, no wish, to regenerate yourselves and better your condition! I do not, I declare, understand you. Had you said, No inclination, I might have managed that. Bethink yourselves, my friends, and get wisdom, at whatever cost or sacrifice.

“I am well aware that you have much to contend against, and many privations to bear with; but you are not alone in that. Others have the same, and perhaps worse. Have a mind to do, and do it and all obstacles will fly. That’s the road to success and renown. Blow the midges out of your path. It can be, and has been done, as I have already told you, by some fully as badly off in every respect as you are, or can be. Even

within my narrow circle of acquaintance, and it is surely narrow enough, I knew one who was untutored as any of you, had as little money as you could have, wrought longer hours than any farm servant ever did, save in harvest, reared a family perhaps as big as any have here or about the country-side, having ten daughters, and each of these lasses has a brother; yet that man found time and means, unaided, mark you, and unencouraged, to do that which has made his name familiar and respected in every quarter of the habitable globe. More. He can now jingle a shilling in his pouch, whereas before, if it did ever see a coin at all, it was simply a bawbee awhile on Sabbath. This is no fabrication—a sensational hitch as it were. I am in a position to prove every word I have said. This, then, is still farther encouragement to you and all like you, whether of the country or the town. Have the will, and take no heed for the rest. Strive after knowledge, and diligently seek that wisdom which is from above. This obtained, everything would be changed to you, would wear a newer aspect. You would be changed yourselves, and in time would feel and see things differently. You would have pleasure and enjoyments you at present have no idea of—your very lives, as a natural consequence, would be sweeter.”

He counts among his proudest possessions a letter sent to him by Lord Beaconsfield, announcing a pension of 50*l.* from the Queen. It was written by the late Premier's own hand, and bore his signature—“Beaconsfield.” This he has had framed with another picture—a cartoon from *Punch*, of which a reduced

sketch is given on page 92. The description of it, as given in that paper, will be interesting. “‘Thomas Edward, shoemaker and naturalist,’” and this greatly amused him, at the fun made at his expense. “A rale guid pictur’,” he says of it.

“Help yourself!” is a good rule, and a capital text, on which Mr. Smiles, some time ago, preached a sermon by examples, with the title of “Self-Help.” The moral of this sermon is summed in the old proverb, “God helps those who help themselves,” for there indeed lies the strength of “Self-help”—it is God’s help. And now Mr. Smiles has preached another sermon on the same text, called “The Life of a Scotch Naturalist.” It is the wonderful true story of a wonderful true man—Thomas Edward, Associate of the Linnæan Society, and souter in Banff; a story to bring tears into the eyes, and to fill the heart with sadness and gladness: a story to make those who read it better, humbler, and gentler, and, above all, more thankful to the great Father of all, who can so mysteriously teach and guide, strengthen and lead up one of the humblest of His children, from eleven years of age till sixty-three an earner of distressful bread at a cobbler’s stool, with an average wage of nine shillings a-week.

Thomas Edward has lived two lives. There was first the humble life of the hardly-brought-up son of a poor weaver; scholar, now and then, for brief spells, of brutal dominies; next apprentice of a drunken ruffian; then toiling bread-winner for a brave and true wife, and a well-reared family of eleven children. This was the man who helped himself.

But side by side with this life he was living another — of communion with the wonderful works of God, who took upon himself *this* part of his teaching, instead of the dominie with his taws and cane; binding him apprentice to nature, instead of to drunken Charley Begg, in the Gallowgate; and after his days of sordid stooping over uppers and twitching at waxed-ends, giving him nights of wonderful intercourse with all living things; appointing him “the beasties” for books, and the silent hours of darkness for his school-time; and holes in dykes, or bields under stone walls, or bits of crumbling ruin, for his schoolrooms. This was the man helped of God.

If you want to know how Thomas Edward lived those two lives side by side, helping himself manfully under the heavy burdens of a poor man among poor men, and letting God help him wonderfully, in gathering wide and rare knowledge of plants and beasts, birds, and creeping things, fishes, and crabs, starfishes, and molluses, till he was able to add new chapters to the great book of natural science, and to teach teachers, and win honour from renowned naturalists, and was, at length, made an Associate of the most famous of their societies, you will find the story told fully and feelingly in Mr. Smiles’ “Life of a Scotch Naturalist,” published by John Murray.

And you will read, too, how close work at the cobbler’s stool by day, and wandering and watching and lying out by night, wrestlings with winter’s winds and frosts, drenchings with rain, wettings from seas, tumbles from cliffs, with long fastings, and spare fare,

at best, of oatmeal cakes and water, played havoc with a strong body, so that at sixty-three, Thomas Edward is an old and crippled man.

In the same book is told the touching story of this man's loneliness and disappointments: how, under the pinch of hard times, he had, again and again, to sell



the collections he had so laboriously made, which he straightway set to making over again, like Robert Bruce's spider; and how the prophet, honoured as he was by wise and famous men far away, was not honoured in his own country—Banff bailies, and Banff

bodies, and Banff souls, being too high—or low—to see the poor souter, bowed over his work, and so lower still.

But you will not read in the book—for that came after it was written—how the Queen and Lord Beaconsfield, having read the story of Thomas Edward's life, were moved by a common thought to put Thomas Edward on the Pension List for a modest fifty pounds a year, so that for the rest of his life he may give himself wholly to the reading of God's Book of Creation, without being a burden to the children who have been true and helpful stays to him thus far. For among Thomas Edward's other good gifts from God, is a good and wise wife, and they have bred good bairns. And so *Punch* takes leave of Thomas Edward—in harbour at last; and, lifting his hat, and holding out his hand to this stout-hearted and rarely-endowed man, craves leave—as the highest honour should come the latest—to offer this *his* tribute of respect after Prime Minister and Queen.





LOUIS JOHN RUDOLPH AGASSIZ.



LOUIS AGASSIZ, by which name he was everywhere known, was born at Mottier, in the canton of Frieberg, on May 28, 1807. He belonged to an old French Protestant family who had been compelled to quit their native country by the revocation of the Edict of Nantes, whence they took refuge in the Pays de Vaud. His father was a Protestant pastor, and for six generations his lineal ancestors had been clergymen. On the mother's as well as on the father's side, Agassiz was richly endowed with a vigorous mind and active disposition.

The mother superintended the education of her boy Louis until he reached the age of eleven, when he was sent with his younger brothers to the gymnasium at Biel, a small town in the canton of Bern, where he was mainly occupied with the study of ancient and modern languages, the acquaintance with which proved

of important service to him in his later biological investigations. His play-hours he devoted to fishing and the collecting of insects. Thus early did his leaning towards ichthyological researches manifest itself, and his knowledge of the habits of fish often astonished even experienced fishermen.

His father was transferred from Mottier to the little town of Orbe at the foot of the Jura. Here, during the vacations, young Agassiz became intimate with a young clergyman named Fivaz, who first introduced him to the study of natural history, and especially botany.

He remained at Biel for some few years, and afterwards entered the Academy of Lausanne, on the shores of Lake Geneva, and, in 1824, betook himself to Zurich to study medicine; for he was obliged to look forward to a time when his knowledge would be his only means of livelihood.

After remaining two years at Zurich he went to Heidelberg, where he continued his medical studies at the University, devoting himself chiefly to anatomy and physiology under the noted Tiedmann, and botany and zoology under Bischoff and Leuckhart. In the autumn of 1827 he entered the University of Munich, which had recently been reorganized. Among the eminent men assembled there, Agassiz formed intimate friendships.

He studied the organization of plants and their geographical distribution with Martius. Döllinger, the great master in physiology and embryology, soon recognized the high talent of the young Swiss, and

ripened in him a long cherished plan of devoting himself to zoology in the widest sense of the term. He was intimate with Wagler; and under Oken—in some respects the most remarkable zoologist that Germany has produced—he studied his curious classification of the animal kingdom. With Fuchs he studied mineralogy; and for four successive years he attended all the philosophical lectures of Schelling.

His fellow-students remember vividly the remarkable appearance of Agassiz at that period; his active and powerful physique, the intellectual beauty of his face, his brilliant eye, and hearty laugh. Although a laborious and devoted scholar, he found time for athletic sports; and, as leading swordsman of the University, was elected president of the Swiss Club, the “*Helvetia*.”

At this the beginning of his scientific life, the bent of his mind towards a combination of natural history with metaphysics was already marked. His studies under Schelling and Oken all pointed in this direction, and the interest he took in both conclusively proved that the essential character of his intellect was the same in youth as in age.

An irresistible passion, an intense longing to tear from nature the secret of life, had now complete possession of Agassiz, and was destined not to lead, but to drive him during the remainder of his existence. The surroundings were, it is true, favourable, but it was because he sought them, and had they not been favourable, he would have sought them

elsewhere. Of this period of his life he afterward wrote: "Our professors were themselves original investigators, daily contributing to the sum of human knowledge. They were not only our teachers but our friends. The best spirit prevailed among professors and students. We were often companions of their walks, often present at their discussions, and when we met for conversation, or to give lectures among ourselves, as we constantly did, our professors were often among our listeners, cheering and stimulating us in all our efforts after independent research."

It was in Munich that young Agassiz, who occupied a room in Döllinger's house, soon gathered around him a circle of young and talented students, to talk over and discuss matters of scientific interest. His room was the meeting-place of this club, which soon assumed the title of the Little Academy and of which Agassiz acted as president. Before this society did Michaelis lay the results of his researches in the Adriatic Seas; Born exhibited his beautiful preparations of the anatomy of the lamprey; Rudolphi lectured to the students on the Bavarian Alps and the coasts of the Baltic; and Schimper and Braun here first expounded the laws of the phyllotaxis. Döllinger himself did not disdain to initiate his disciples and friends of this Little Academy in his newest discoveries and ideas, ere he made them known to the scientific world, and here he taught them the use of the microscope in embryological research.

When Don Pedro of Brazil married an Austrian princess, the Austrian and Bavarian governments availed themselves of the opportunity of sending to that country a scientific exploring expedition. The naturalists who accompanied it were Martius, Spix, Natterer, and Pohl. Agassiz, still a student, had already published a few special papers. On the return of the scientific corps Martius occupied himself with the publication of his great work on Brazil. The zoological portion was intrusted to Spix, but he had not completed it at the time of his death. Martius at once selected young Agassiz to elaborate the ichthyological department, upon which very little had been done, and the manner in which he accomplished the task placed him at once in the foremost rank of naturalists. This work was published in Latin at Munich in the year 1829, and was dedicated to Cuvier. These studies and labours diverted him from the profession of medicine, to which he had been destined by his parents. The allowance he had hitherto received from his father, on which, moderate as it was, he had not only subsisted, but had employed a distinguished young artist, Dinkel, was now withdrawn.

Agassiz now applied to Cotta the publisher, who struck by the value of the materials the former had collected for a "Natural History of the Fresh-Water Fishes of Europe," and no doubt impressed with the genius of the young naturalist, enabled him by a timely supply of funds to complete the work. This was his second great undertaking.

About this time he presented himself as a candidate for the degree of doctor of philosophy, which he took at Erlangen, after passing a very severe examination with distinction. In the same year he took at Munich the degree of doctor of medicine, on which occasion he maintained the superiority of woman in a Latin dissertation upon the thesis, *Femina hominum superior mari*.

It was at this time that he began his investigations on fossil fishes. The immediate occasion of this step was a short notice by Professor Rudolph Wagner on the fossils of the Munich Museum, in which he praised the number and beauty of the unnoticed fossil fishes. Agassiz immediately applied to Professor Fuchs, who had the care of the palæontological collection, for permission to investigate the ichthyolites in detail. Professors Wagler and Schubert placed freely at his disposal the collection of recent fishes and their skeletons, and Döllinger, Oken, and Martius in various ways encouraged him in this difficult undertaking. To this great work he devoted seven years of study before beginning the publication. This was continued through ten years, and was brought to a close in 1844.

In the course of his preparation for this work Agassiz visited the principal museums of Europe, accompanied by a skilful artist; and so great was the interest felt universally in these researches, and the confidence which the author inspired, that he was allowed to take with him for examination and comparison the most valuable specimens of more than eighty public

and private museums, some of which he was permitted to retain from five to ten years.

He came to London with letters of introduction to Sir Roderick Murchison.

“You have been studying nature,” said the great man. “What have you learned?”

Agassiz was of a timid nature and the opposite of egotistical, and after a pause said,

“I think I know a little about fishes.”

“Very well. There will be a meeting of the Royal Society to-night. I will take you with me there.”

Towards the close of the meeting that night he said: “I have a young friend here from Switzerland who thinks he knows something about fishes; how much I have a fancy to try. There is under this cloth a perfect skeleton of a fish which existed long before man.” He then gave some particulars as to where it was found, and afterwards said to Agassiz,

“Can you sketch for me on the blackboard your idea of this fish?”

Agassiz took up the chalk, hesitated a moment, and then rapidly sketched a fish. Sir Roderick held up the specimen, and it was found that the drawing was correct in every bone and line, and there was a burst of applause.

Agassiz said that that was the proudest moment of his life.

In 1830 he went to Vienna where he stayed a year, attending at the hospitals, and studying in the Imperial Museum the splendid collection of sturgeons of the

Danube region, as well as the fossil fishes of Monte Balca. Moreover, he was so interested in the cyprinoids of the Danube, which were already partly known to him from those of the Isar, that he concluded a work on the Fresh-Water Fishes of Central Europe. On account however, of the Revolution of July, 1830, this work was not published.

The years 1831 and 1832 Agassiz spent in France, and in Paris had much pleasant intercourse with Cuvier and Alex. von Humboldt. Cuvier was then giving a course of lectures on the history of natural science, and combated with all the power of his science and his detailed knowledge of the organic structure of the whole animal world, the development theory of Geoffroy, based on the variability of species, which the latter defended in the sittings of the French Academy. From this time Agassiz adhered to Cuvier's ideas on the classification of the animal kingdom, and on creation catastrophes especially, and, with but little modification, defended them in his teachings and writings to the close of his life.

The drawings of Agassiz so delighted Cuvier—who had just commenced his work on fishes—that he offered to relinquish to the young man all the materials he had himself collected, and from that time to his death he cherished a warm friendship for the Swiss naturalist, and received him in his family on the most intimate terms.

In Humboldt, again, Agassiz found an attached and powerful patron, whose support at a later time essentially facilitated the publication of many of his costly

works, and to whose recommendation he in part owed the brilliant reception he met with in America.

With his residence in Paris the student life of Agassiz may be said to have ended. He was about to begin a profession which was one day to become an engrossing one, and one never to be relinquished—the profession of a teacher. In 1832 he applied to M. Louis Coulon to obtain for him a position as professor of natural history in the Gymnasium of Neuchâtel. No such chair then existed; but M. Coulon raised money enough to guarantee for three years a salary of 2,000 francs, and the new professor was duly installed, already planning the best way of laying out so considerable an annual sum as £80. He found no museum there, and for lack of a lecture-room was obliged to give his course in a hall of the town-house. But this ill-provided teacher soon brought his branch to overshadow all others in the Gymnasium. From all parts of Switzerland came young and talented pupils and friends of nature thither and gathered round Agassiz, who understood how to inspire them with his great ideas.

He sent for the specimens he had amassed in Germany, and with ceaseless activity added fresh ones, until a tolerable collection was ready for display and study. Then, with the confidence of a man having abundant resources in money and power, he proceeded to surround himself with the appliances of a great scientific centre, and to enter on a series of original investigations which might well have taxed the powers of three able men.

He had constantly employed two artists, Weber and

Dinkel, and a painter, Jacques Burckhardt, who had been his fellow-student at Munich, and who remained his life-long companion. Stahl, since noted as the best modeller at the Jardin des Plantes, was then employed at Neuchâtel. Hercule Nicolet, summoned from Paris, was persuaded to set up, in this new home of science, a large lithographic establishment, where were published the last plates of the "Poissons Fossiles"; those of the "Poissons d'Eau Douce"; of the embryology of *Coregonus*; of the works on the Glaciers; and of the Echinoderms.

The "Little Academy" of Munich now took on a new shape, and reappeared as *La Société des Sciences Naturelles de Neuchâtel*. Its first meeting was in December, 1832, when Louis Coulon was chosen President, and Louis Agassiz Secretary of the section of Natural History.

The next fourteen years, during which he held the chair in Neuchâtel, were especially his years of research and publication; and it is hardly conceivable that one man, even with able assistants, could within that period have done such an enormous amount of work. Thus far his attention had been directed chiefly to the class of fishes in which Martius had interested him. Their study had led him into palæontology, because of the great quantity of fossil species which had hitherto been the despair of ichthyologists. Fishes whose skeletons were soft and which had thick muscles, were so crushed and distorted as to be unrecognizable, and the viscera were almost never to be distinguished. In the course of an exhaustive study of their anatomy, Agassiz

discovered that the scales of fishes correspond by four kinds of structures to four grand natural divisions, which he called Ganoids, Placoids, Cycloids, and Ctenoids. With this basis, and aided by an intimate knowledge of the skeleton, he was enabled to tabulate all the known fossil species. These formed his gigantic work published as "Recherches sur les Poissons Fossiles," the publication of which at Neuchâtel extended over ten years. It formed five quarto volumes, with 311 folio plates. Eighty of the greatest museums of Europe had furnished the materials for it, and the number of described species amounted to 1,700 in about 20,000 examples. This is, undoubtedly, the greatest work of Agassiz, and forms, with Cuvier's and Valenciennes' "Histoire Naturelle des Poissons," and Johann Müller's Treatises, the foundation of our present knowledge of fishes, while it does not confine itself to the region of ichthyolites, but extends over the entire wide field of the anatomy and classification of fishes, essentially modifying the latter. Agassiz considered, and with justice, that the separation of the ganoids from the other fishes into the rank of a special order was the greatest step towards progress for which science was indebted to him, and on the basis of the comparison of the fossil fishes of formations with living forms, he enunciated several generally valid laws, which have had an important bearing on the development theory of the whole organic world.

The preparation of this work was laborious in the extreme. Agassiz was obliged to travel with an artist, in order to examine and figure the specimens which

could not be sent to Neufchâtel. The expense, too, was far beyond his slender means, so that, despite the aid obtained through Humboldt and other warm friends, he incurred heavy debts which hampered him for many years. He was, however, a man who counted neither money, nor time, nor labour, when knowledge was in the balance, and he hesitated not to enter on new and intricate investigations in the midst of his original work.

Being greatly interested in the subject, he found time to devote to the study of living fishes. Thus may be mentioned his treatise on the cyprinoids, published in 1834; the great work brought out in conjunction with Carl Vogt between 1839 and 1845, on the fresh-water fishes of Central Europe. In 1842 he brought out his important "Nomenclator Zoologicus," the result of many years' gatherings, and which contained an alphabetical arrangement of the specific names of the entire animal kingdom, their etymology, information as to the authors who had proposed these names, as well as the year of their appearance. The "Nomenclator" found a magnificent conclusion in the "Bibliographie Générale d'Histoire Naturelle," printed at the cost of the Ray Society.

Such was the mental capacity of Agassiz, not yet thirty years of age, and such his endurance of continuous labour, that these numerous threads of research, instead of producing a hopeless tangle in his mind, seemed each to serve as a separate clue to the truth of nature.

While he, no doubt, exercised a considerable influ-

ence on geology by means of his palæontological researches, still it is as a glacialist that the name of Agassiz will always be prominently associated with that science. Venetz's, Schimper's, and especially



View of the Jungfrau.

Charpentier's observations and theories on the greater extension of glaciers and their relations to erratic blocks attracted the attention of the young naturalist in 1836 to the glacial phenomena of Switzerland. Charpentier's theories on the former extension of

glaciers and other points especially interested Agassiz, who gave himself with his peculiar energy and fertility of idea to the study of the subject. With Gyt, Desor, Studer, and other young friends, did he during several years visit most of the glaciers of Switzerland and examine them in their entire extent, from their origin to their lowest margins. In 1841 the ascent of the Jungfrau was undertaken. In the middle of the Aar glacier, at a height of 8,000 feet above the sea, twelve miles from any human habitation, protected by a huge block, a station was erected, which latterly obtained a European celebrity under the name of "Hôtel des Neufchâtelois." Here for fully eight years were researches carried out on the origin of glaciers, the forward and backward oscillations, the structure and thickness of the ice as well as its formation, the origin of moraines, etc. In 1840 appeared Agassiz's first great work, "Études sur les Glaciers," in which he thoroughly discussed the chief phenomena of glaciers, and developed his views on their general extension. In a second work, "Système Glacial," he gave a satisfactory account of the observations made in the years 1841-45, especially on the progress of glaciers in various years and under the influence of conditions of temperature. The adoption of a special glacial period was the final result of Agassiz's research among the glaciers of Switzerland, as well as those of Scotland and Wales. The immense importance of this theory, both in geology and biology, was soon recognized, and its discussion has engaged the earnest attention of the

ablest men in all departments of science. He proved unmistakably that in the position of the visible parts of the earth as they stand, water had been an agent in a form before scarcely thought of and to an extent before not apprehended. He showed that in the form of vast rivers of ice it had modified the terrestrial surface most materially in places where the climate no longer permits of such action. The discoveries of Agassiz also gave an explanation for the existence of boulders or large water-worn stones, in positions far above the reach, nowadays, of the agencies to which they must have been at one time subjected.

From 1846 the biography of Agassiz belongs to the natural history of the United States. At the suggestion of Mr. (afterwards Sir) Chas. Lyell, Mr. (now Hon.) John A. Lowell had, in 1845, invited Professor Agassiz to Boston, to deliver a course of lectures before the Lowell Institute. The Bostonians claim, and with reason, to represent the best of American intellectual life, so that this was no slight compliment. About the same time that the invitation reached Agassiz, the King of Prussia, through the ever-thoughtful mediation of Humboldt, had presented him with a sum of money in aid of a scientific mission to America. Thus encouraged by invitation and by pecuniary aid, he crossed the Atlantic in the autumn of 1846, and made his *début* in the United States as a lecturer. His first lectures were on the subject of Comparative Embryology, and they were listened to by audiences of from 1,500 to 2,000, embracing all that was most cultivated in science and

letters in Boston and the vicinity. This course of lectures led to important results. It aroused an enthusiasm for the study of nature in the widest circles; and Agassiz understood how to make the scientific development of North America in this direction a matter of honour for the whole nation.

Immediately afterwards, by special request, he delivered another course of lectures upon the glaciers and the phenomena connected with their former greater extension.

Hitherto Agassiz had been the brilliant discoverer, now he was to be the explorer and the teacher. In 1847, Mr. Abbott Lawrence, with the same judicious selection that M. Coulon had shown fifteen years before, offered to found for Agassiz a professorship of zoology and geology in the Scientific School at Harvard College, Cambridge, Mass. Having obtained an honourable discharge from his European engagements, he accepted the appointment, and gave up all thought of returning to Europe. He placed his activity, his science, and his talents, at the disposal of the nation that showed itself so anxious to keep him, and where he would enjoy a social power and a liberty, which were hardly possible to the *savans* of the Old World.

As in Neuchâtel, so in Cambridge, Agassiz in a very short time attracted around him a circle of young men, enterprising lovers of natural science. He entered upon his duties at Cambridge in the spring of 1849, and at the close of the academic year started with twelve of his pupils upon a scientific

exploration of the shores of the Lake Superior. The results of this journey appeared in the well-known work, published in 1850, "Lake Superior: its Physical Character, Vegetation, and Animals," in which Agassiz discussed in detail the erratic phenomena of the lake, its future form and extent, and the character of its ichthyological and reptilian fauna. The narrative part was written by Mr. J. Eliot Cabot, together with the reports of the lectures which the Professor delivered at the close of each day; and Mr. J. Le Conte contributed the account of the coleoptera. In succeeding years, he made similar expeditions with his pupils into the interior of the United States, and with the collections brought back laid the foundation of a natural history museum, which until then had no existence at Harvard University.

At the request of Professor Backe, of the Coast Survey, Agassiz passed the winter of 1850 among the Florida reefs, where he determined the law of growth by which that peninsula has gradually extended southward by the successive formation of reefs, keys, and mud flats.

His stay at Charlestown, South Carolina, led to his appointment in 1852, to the chair of Comparative Anatomy at the Medical College; but he returned to Cambridge after two years, the warmer climate of the south not agreeing with him. Soon after he visited all the great towns of North America, lecturing in all departments of zoology and geology. Everywhere he was received with enthusiasm, for his expositions were remarkably clear, and full of

suggestive thought ; his language noble and fluent ; his knowledge of human science of the widest ; his manner so charming, and his conversation so full of instruction, that every one felt it a privilege to be near him.

From that time Agassiz became the declared pet of the Americans, and was one of the most popular men in the country, and in intellectual matters became one of its greatest benefactors, exercising his influence in improving education, and in increasing educational establishments.

In 1855 he began to prepare for the publication of a magnificent work—"Contributions to the Natural History of the United States." In a short time the necessary means were obtained by subscription, and in 1857 the first volume appeared. Unfortunately, this work only reached its fourth volume. The first contained as an introduction the universally known and much discussed "Essay on Classification," which latter, as a separate work, was republished in London and Paris. Agassiz treated in this work the questions of the origin, development, and systematic arrangement of the organic world, and developed from these his philosophical views which he had obtained from his own studies and observations, and which stand in direct opposition to the theory of descent.

Agassiz was, however, not destined to resume his old habits of investigation and publication. The will of Mr. Francis C. Gray established in 1858 a fund for the support of a museum of comparative anatomy, and a liberal private subscription, seconded by a large gift from the state, assured the future

of the establishment. Henceforth the current of Agassiz's thoughts ran in a new channel. In the words of a contemporary, "he determined to found a great museum arranged to show his views of the relations of living animals among themselves, and their connections in the geological and embryological successions. Such a museum he hoped to leave as a legacy—his all—to the people of this country (America), and to make it at once a mark of his affection and a monument of his labour. He gave less and less of his time to those special investigations by which he had gained his reputation, and pondered more and more on this museum, which should serve as a tabulation of the creative thought by presenting the creatures themselves in a connected order."

Day by day he laboured to increase his collections and to forward their arrangement. His Brazilian expedition, undertaken in 1865, at the cost of Mr. Nathaniel Thayer, brought back vast riches in natural history specimens. Not the sight, however, of familiar fishes that took him back to Munich and the time of Spix and Martius, could turn him again to special studies. He kept on with ever-increasing toil, and yet preserved his relations to the public, his popular lectures, his interest in education and agriculture, his voluminous correspondence. All this, in addition to his duties as Professor of Natural History, was too much even for his powerful frame, and in 1869 he was seized with a cerebral attack which threatened his life. From it he recovered only to enter, with all the spirit of a youth just beginning the world,

upon the Hassler Expedition of 1871, which was under the direction of the Coast Survey. He endured without complaint the hardships of a voyage round Cape Horn in a small steamer, and returned laden with new collections.

A minute exploration was made of the Saragossa Sea, and a nest-building fish was discovered in the vast bed of oceanic vegetation, and other important contributions were made to natural science.

At the end of 1873 his career was suddenly and unexpectedly closed by death. In full harness and abundant enthusiasm for the studies which he deeply loved, he passed away. The American papers were full of eulogistic records of his attainments and qualities as a man; but for my present purpose, it will only be necessary for me to quote one short notice written by an eminent American, and which appeared in the report of the American Academy of Arts and Sciences for 1873. It reads as follows:—

The last year of his life was a very happy one. He saw the museum well supplied with funds, growing in size, and advancing towards arrangement. There came besides, from Mr. John Anderson, the gift of the Island of Penikese, and a large sum in money, to found a summer school of natural history. It was at once started with about fifty pupils, and Agassiz had the great pleasure of founding the first establishment of the kind in the world.* But he killed himself in doing it.

* The station of Dr. Dohrn, at Naples, is of a different character, and was not then in working order.

It was precisely this new and prolonged strain, at a season when usually he took a sort of vacation, that shattered his system beyond the power of repair; and on December 14, 1873, he died.

If we consider simply the influence of his philosophical opinions on the mass of scientific men, Agassiz lived too late and also too early. At all stages of its progress, the human mind presents a kind of atrophy of some of its parts; and he who treats of such topics as are appreciated only by these parts speaks to deaf ears. Continuance in one set of opinions through several generations produces at last lassitude, then a sort of rebellion, and finally the welcoming of anything novel, as a glad relief. Here is a great, if not the greatest cause of changes which are on the whole beneficial. The tree of knowledge at such times throws out new and strong branches, albeit they are all on one side. Thus it has been with natural science. Scholars get tired of Bridgwater Treatises, and talk of means and ends, and of plans of creation; moreover, they were in some places exasperated by opposition from Church or State. Then they were getting suffocated by their material; and, when the species of shells increased to thousands, and of beetles to tens of thousands, they exclaimed, "It is enough—give us relief!"

Their relief was like that of the Mediæval Catholic Church. Positivism advanced, and said, "Bury everything that is inconvenient, and come and lean on me and I will give you peace. Thought and causation have no real existence. They and you are only figures in a procession that has neither beginning nor end. Amuse

yourselves, therefore, by looking at this procession, until the inevitable comes upon you." This is the philosophy which to-day is powerful among thinking men; and its tide is fated to rise higher before it ebbs. Like all systems, it will work good and evil; but its good will remain, and its evil melt away.

Against such a current Agassiz struggled in vain. He was a theistic philosopher, who chose for his field the working of supreme thought in the animal creation. He addressed a world of learned men, the majority of whom could not understand what basis theistic philosophy had, and of whom not a few accused him of want of honesty for even introducing such a theme. The time will come when his power and insight will be appreciated. Meanwhile we must be content with his successes that lay in a lower plane; they were his special zoological investigations, and his brilliant career in the United States, where he raised an enthusiasm for high studies, and where he established a great centre of science.

On his fiftieth birthday, the late poet Longfellow, who lived for some years a neighbour of Agassiz, and was a fellow-professor with him in Harvard University, addressed to him a poetical tribute, which I cannot do better than quote:—

It was fifty years ago,
 In the pleasant month of May,
 In the beautiful Pays de Vaud
 A child in its cradle lay.
 And Nature, the old nurse, took
 The child upon her knee,
 Saying, "Here is a story-book
 My Father has written for thee.

“ Come, wander with me, ” she said,
“ Into regions yet untrod,
And read what is still unread
In the manuscripts of God ! ”

And he wandered away and away
With Nature, the dear old nurse,
Who sang to him night and day
The songs of the universe.

And whenever the way seemed long,
Or his heart began to fail,
She would sing a more wonderful song,
Or tell a more marvellous tale.

So she keeps him still a child,
And will not let him go,
Though at times his heart beats wild
For the beautiful Pays de Vaud,

Though at times he hears in his dreams
The Ranz des Vaches of old,
And the rush of the mountain streams
From glaciers clear and cold.

And the mother at home says, “ Hark !
For his voice I listen and yearn ;
It is growing late and dark,
And my boy does not return ! ”

He possessed many admirable traits of character. There was about him no vain ostentation, but in manner he had a child-like naturalness which made his society exceedingly instructive and agreeable. He evidenced too at all times a reverent spirit. Deeply did he realize the grandeur and uses of life ; and in his investigations of the wonders of nature he felt that he was searching out the thoughts of God. The

books which he left behind him as his chief legacy to mankind adduce testimony wherein he sees the manifestation of a mind as powerful as it is prolific; the acts of an intelligence as sublime as it is provident; the marks of goodness as infinite as wise; and the clear demonstration of the existence of an Author of all things, Ruler of the universe.





CUYIER.



OF the distinguished individual whose history forms the subject of the present paper it has been truly said:—"His various acquirements, equally vast and minute, his multiplied labours, his elevated views, his private virtues, have furnished to each admirer so many topics of just eulogy. The naturalist, the moralist, the orator, the statesman,

have each acknowledged the sympathy which binds them all to a man in whom every variety of merit seemed to be united, and whose eloquence equally adorned and enforced the philosophy of science and of life. His attached friends, and the pupils who revered him and loved him, have felt that the contemplation of such a character charmed and elevated their own, and have lingered over reminiscences, before which all that was mean, or indolent, or intellectual fled away."

The parents of young Cuvier inflicted upon him a terrible string of Christian names, for it was in full, Georges Chrétien Léopold Frédéric Dagobert Cuvier, was born at Montbéliard (then belonging to the Duke of Würtemberg), August 23, 1769.

The family came originally from a village in the Jura, which still bears the name of Cuvier; but becoming the victims of religious persecution they were much impoverished, and were driven to settle at Montbéliard at the period of the Revolution, and where some of its members held offices of distinction.

The grandfather of Cuvier had two sons, the younger of whom entered a Swiss regiment in the service of France. A brave man and an excellent officer, he rose to high honours, and at the age of fifty married a lady considerably younger than himself, and had three sons. The eldest died in infancy, the second became the naturalist, and the third was Frédéric Cuvier. As Georges had a delicate constitution, his mother watched over him with the tenderest care. She taught him to read, made him repeat to her his Latin lessons, instructed him in drawing, and developed that ardent desire for knowledge which was so remarkable in him.

At the age of ten he was placed at a school called the Gymnase, where he remained for four years. He made rapid progress, and was constantly at the head of the classes of geography, history, and mathematics, and acquired Greek and Latin with readiness.

At this early period his taste for natural history

was stimulated by reading a copy of Buffon, which he found at the house of a relative; and his memory was so retentive that, at the age of twelve, he was perfectly familiar with the descriptions of birds and quadrupeds. At the age of fourteen he formed a kind of academy from among his school-mates, of which he was president. He drew up the regulations, and fixed the meetings for every Tuesday at a stated hour, and seated on his bed, and placing his companions round a table, he ordered that some work should be read which treated either of natural history, philosophy, history, or travels. The merits of the book were then discussed, after which the youthful president summed up the whole, and pronounced a sort of judgment on the matter contained in it, which judgment was always strictly adopted by his disciples.

He was then remarkable for his declamatory powers; and on the anniversary fête of the sovereign of Montbéliard (Duke Charles of Würtemberg) he composed an oration in verse on the prosperous state of the principality, and delivered it fresh from his pen, in a firm, manly tone, which astonished the audience. On account of a prejudice on the part of the head of the school, arising from annoyance at some sarcasms in which young Cuvier had indulged, this display of talent did not meet with its proper reward; and instead of being placed in the first rank of the themes presented, it was included in the third rank. This was the more vexatious, as the station of the boy at college

depended on it; and though Cuvier afterwards felt that the change in his destiny—he was preparing himself for the Church—which resulted from this circumstance was one for which he had much reason to be thankful, yet at the time its evident injustice was severely felt.

The fame of the young student, however, and his disappointment, reached the ears of Duke Charles, and when on a visit to Montbéliard, he sent for Cuvier, and took him under his special favour, and sent him to the Academy of Stuttgart, in March, 1784.

After studying philosophy for twelve months, he applied himself to the science of fiscal administration, because it gave him an opportunity to pursue his favourite natural history in books, in the fields, and in cabinets. One of the professors gave him a copy of Linnæus' "System of Nature," which was his library on natural history for several years. While occupied by such reading and the collection of specimens, he also obtained several prizes in his class studies, including the prize for the German language.

At the termination of his academical career, Cuvier was promised a place in the service of his country when a position became vacant; but circumstances compelled him to seek employment in a manner wholly different from his own wishes, or the hopes of his patron. The unsettled state of finance in France caused his father's pension to be withheld; and being thus unwilling to burden his father, and unable to wait, perhaps two or three years, till an oppor-

tunity of advancing his fortunes should be presented to the Duke, Cuvier was obliged to accept the offer of M. Parrot, a countryman, and become a private tutor in a Protestant family. Those who knew his extraordinary talents considered the office as a lamentable waste of his powers; but here, again, that which was considered a serious misfortune proved a stepping-stone to fame and success. In July, 1788, Cuvier arrived at Caen, in Normandy, as private tutor in the family of Count d'Héricy, for the education of his son. In this situation he remained until 1794.

On arriving at Caen, he brought with him that love of labour, that depth of reflection, perseverance, and uprightness of character, from which he never swerved. To these admirable foundations for renown he afterwards added that remarkable clearness of system, perfection of method, and tact of giving only what is necessary, followed by that elegant summing up of the whole which particularly distinguishes the French writers: the whole was completed by the most perfect modesty and that respect for his own esteem without which talents become the medium of traffic for the mere acquirement of wealth. Whilst with the Count's family, Cuvier saw all the nobility of the surrounding country, and acquired the forms and manners of the best society. It may be said that, engaged as he was as a private tutor in a retired district at the age of twenty-one, he laid the foundation of that fame which was to fill the world, and to reach to distant ages.

He pursued at Caen natural history with great zeal, the district being very favourably situated for the study both of terrestrial and marine animals. Some *terebratule* having been dug up in his vicinity, he conceived the idea of comparing fossils with living species. The dissection of some molluses suggested to him the necessity of a reform in the classification of animals; and here originated the germ of his two great works, the "Ossemens Fossiles," and the "Règne Animal."

He said to a friend regarding his observations and thoughts which he had committed to paper: "These manuscripts are solely for my own use, and doubtless contain nothing but what has been done elsewhere, and better established by the naturalists of the capital, for they have been made without the aid of books or collections." Nevertheless, almost every page of these precious manuscripts was full of new facts and enlightened views, which were superior to almost all that had previously appeared.

While he was thus employed, a society was formed at Valmont, in his neighbourhood, for the encouragement of agriculture. L'Abbé Tessier had sought at this place a refuge from the persecutions of the revolutionists, and at one of the meetings of the new society, Cuvier discovered this learned old man, under his disguise of a surgeon, and addressed him by name. He had been able to recognize him from his style of speaking, which strongly resembled that of his writings; but the recognition was at first the cause of alarm to the poor abbé, who was then under proscription.

He found in Cuvier, however, a generous friend and admirer, and was so delighted with his talents, that he afterwards wrote of him to Jussien in terms of the highest commendation.

Through his acquaintance with M. Tessier, he began a correspondence with Geoffroy St. Hilaire, Lapécède, and other Parisian *savants* on subjects of natural history; and in the spring of 1795 he accepted their invitation to go to Paris, and was appointed professor in the central school of the Pantheon, for which he is said to have composed his "Tableau élémentaire de l'Histoire Naturelle des Animaux," in which he first published his ideas on zoological arrangement.

M. Mertrud had been appointed professor of comparative anatomy at the Jardin des Plantes. Feeling himself unable from age to discharge all its duties, he called upon Cuvier to assist him, who at this time invited his brother Frédéric to join him, and commenced the collection of comparative anatomy, which has since become so famous and extensive.

In 1796 the National Institute was formed, and Cuvier was associated with Lapécède and Daubenton in the section of zoology, and was its third secretary. The death of Daubenton, at the close of 1799, made vacant for Cuvier the chair of natural history at the Collège de France in 1800, and in 1802 he succeeded Mertrud as professor of comparative anatomy at the Jardin des Plantes.

In 1796 he announced his discovery of red blood in leeches, and in the following year he read his celebrated paper on the nutrition of insects.

On the return of Napoleon from Egypt in 1800, when he was made First Consul, and was ambitious of every variety of fame, he placed himself at the head of the Institute, and had thus occasion to witness the talents and sagacity of Cuvier. He was hence induced in 1802 to appoint him one of the six inspectors-general for establishing Lyceums in thirty towns of France; and it fell to the lot of Cuvier to found those of Marseilles, Nice, and Bordeaux, which are at present royal colleges. During his absence from Paris, the Institute was remodelled, and he was elected one of the perpetual secretaries, viz., that for the natural sciences, at an annual salary of £240.

On the death of his father, and also of his brother's wife, who had managed the domestic affairs of the family, he married, in 1803, the widow of M. Duvaucel, one of the farmers-general who had perished on the scaffold in 1794. Without fortune, and with the burden, or as Cuvier found it, the blessing, of four children by her first husband, this lady contributed largely to his happiness. She brought him other four children, all of whom he was fated to survive; but these afflictions were the darkest, if not the only clouds which interrupted the sunshine of his felicity. The balance of good and evil with which his lot was cast was thus bitterly destroyed; but Providence heaped wealth and honours into the uplifted scale and weighed it down with the consciousness that they were the rewards of virtue and of knowledge.

In 1808 Cuvier, in his character of secretary, wrote a report on the progress of the natural sciences from the year 1789. A mere report was demanded, but the author produced one of the most voluminous treatises that had ever appeared. This report was presented to the emperor, and in the same year, when Napoleon created the Imperial University, Cuvier was made one of the councillors for life, and was thus brought constantly into the immediate presence of the emperor.

In 1810 he commenced a series of journeys for the purpose of organizing the foreign department for public instruction. He began with the academies of the Italian States, then examined those of Holland, and finally those of Lower Germany. These journeys were doubly useful to him by establishing his health, which had suffered in consequence of his incessant labours, and by giving him an opportunity of visiting the museums of those countries, where he took drawings of new objects, particularly of the fossil remains of Tuscany, of which he had procured a great number.

In 1811 his most important scientific work appeared—that on fossil remains; and he also wrote admirable reports from Holland and the Hanseatic towns.

While at Hamburg the title of Chevalier was conferred upon him by the Emperor, and assured to his heirs. But worldly honours were not to be transmitted to his posterity; for after losing a daughter four years of age in 1812, he was bereaved of his son in 1813, who was seven years of age.

The impression produced by this last stroke was never entirely effaced. Often when walking with his daughter he would stop before a group of boys, who as they played reminded him of his child. This loss happened to him when in Rome, then annexed to the French empire, where he was sent to organize the universities.

During Cuvier's sojourn at Rome, Napoleon from his own personal feeling appointed him Master of Requests in the Council of State; and before the year had closed, he appointed him *Commissionaire Impérial Extraordinaire*, and sent him to Mayence to rouse the inhabitants of the left bank of the Rhine against the allied troops that were in full march upon their territory. The rapid advance, however, of the enemy compelled him to return, and his zeal in the cause of his country was rewarded in 1814 by the rank of Councillor of State. Louis XVIII. not only continued our philosopher in this honourable office, but appointed him to the temporary situation of *Commissionaire du Roi*, in which it became his duty to defend all new and improved laws before the two chambers.

The tornado of the Hundred Days, though it hurled Cuvier from the Council of State, left him in possession of his office in the university; and after the second revolution, he was elevated to the rank of its chancellor.

In 1818 he visited London, and remained there with his family and secretary for six weeks, visiting everything worthy of notice. His remark to his

Majesty, George IV., concerning our natural history was, that if the private collections could be massed into one, they would form a great national museum which would surpass every other.

The election for Westminster was going on at the period of his visit, and he frequently dwelt on the amusement he had derived from being on the hustings every day. "These orgies of liberty were then unknown in France, and it was a curious spectacle for a man who reflected so deeply on all around him, to see and hear our orators crying out at the tops of their voices to the mob, who pelted them with mud, cabbages, eggs, and other sundry missiles; and Sir Murray Maxwell, in his splendid uniform, flattering the crowd, who reviled him, and sent at his head all the varieties of the vegetable kingdom." Cuvier frequently described this scene with great animation.

At Oxford, to which he was conducted by Dr. Leach, he was received with great distinction, and its splendid collections made a deep impression upon his mind, and often called forth his admiration. He joined Madame Cuvier and his daughter at Windsor, and after admiring the Castle, &c., they went to pay a visit to Sir Wm. Herschell, at Slough, where a cloudy evening prevented them from observing any of the celestial phenomena through that astronomer's splendid telescopes.

The kindness and hospitality with which Cuvier and his family were everywhere received were remembered with the most grateful feelings; and the favour-

able impressions which this visit had given him of England and her institutions, has been recorded in his *Eloge* of Sir Joseph Banks, where, without any feeling of jealousy, he bears a just and noble testimony to our national greatness.

In 1818, before Cuvier had quitted England, he was elected a member of the Académie Française, on which occasion he delivered a discourse of extreme beauty and elegance. In the following year he was made President of the Comité de l'Intérieur, and created a baronet. In 1822 his appointment to the office of Grand Master of all the Faculties of Protestant Theology was made. In 1824 as president of one of the Councils of State, he took part in the coronation of Charles X., on which occasion he was made Grand Master of the Legion of Honour and Commander of the Order of Crown by the King of Würtemberg. In 1827 he was appointed Censor of the Press, but the office was so odious to his feelings that he instantly and firmly refused it, although at the risk of losing all his other offices by so doing. Charles X. exhibited some displeasure on this occasion; but afterwards gave further proof of confidence in him by charging him with the administration of all the non-Catholic religions in France.

Sacrificing everything to the interests of science, Cuvier formed a vast library, and permitted naturalists who sought the privilege, to go and work in it as in a public library. No mean spirit of jealousy of the discoveries of others ever displayed any power over the spirit of this extraordinary man; on the

contrary, he rejoiced at the advancement of knowledge by whomsoever effected, and even when it led to alterations in what he had himself propounded. At his request travellers were sent by government into all parts of the world to collect observations and specimens for the enrichment of the museum. Each of these travellers received directions and instructions from his own mouth; so that it might be said of him as of Linnæus, that Nature was everywhere interrogated in his name.

In the year 1827 Cuvier lost his only daughter, Clementine, at the age of twenty-two, and then on the eve of her marriage. This sad event, the loss of their only child, overwhelmed the disconsolate parents in grief. The feelings of Cuvier could scarcely be controlled. The framework of his mind reeled like a vessel in full sail that strikes upon a rock, and he rushed to his studies as the only anchor by which his distracted faculties could be held. Many a furrow, the channels of many a tear now marked his manly cheek, and his fine hair suddenly changed to a silvery whiteness. But though thus prostrate, he did not

“Perish with the reed on which he leant.”

He found relief under the high pressure of intellectual labour, and he continued for a few years to pursue the studies to which his life had been so successfully devoted.

After this period, Cuvier seems to have worked harder than ever; and a new proof of his perseverance came out in 1829, being a second edition of the “Règne

Animal," with additions and modifications. To this succeeded vols. 3 and 4 of his "Ichthyology", the former volumes having appeared the year before.

In the year 1830, Baron Cuvier opened a course of lectures on the history and progress of science in all ages, which he continued till the end of his life. In the same year he paid a second visit to England, and he was in London when the French Revolution was consummated. Like many others, Cuvier had not anticipated any violent crisis from the *ordonnances* of Charles X., and he quitted Paris under the influence of this opinion. Before, however, he had been five hours absent from the barriers, firing commenced in Paris. The flying English overtook him near Boulogne, but though anxious to return, he doubted if he should be able to re-enter Paris, or even to retrace his steps, with the passports of Charles X. He accordingly awaited at Calais the details of the Three Days, and having received assurances that perfect tranquillity prevailed at Paris he proceeded to England, where he remained only two weeks.

Under the government of Louis Philippe, Cuvier retained all his dignities and offices. In 1832 he was made a Peer of France, and his appointment of President of the entire Council of State only waited for the royal signature, when his career was suddenly terminated by death.

On May 8, 1832, he had opened his course of lectures at the Collège de France. After the first lecture he felt pain and numbness in the right arm, and his throat became affected; on the third day both arms were

seized, and the power of swallowing was lost, all his mental faculties and the power of speech remaining unaffected. He was perfectly calm and resigned.

Four hours before he died he was carried at his own request into a cabinet where the happiest and proudest moments of his life had been spent, and where he wished to draw his last breath.

“Four hours before his death,” says Baron Pasquier, in his *Eloge*, “I was in that memorable cabinet. His countenance was in a state of perfect repose, and never did his noble head appear to me more beautiful, or worthy of admiration. No alterations of a too sensible or painful kind had yet taken place, only a little weakness and difficulty in supporting himself were observable.

“I held the hand which he extended to me, while he said, in a voice scarcely articulate, ‘You see what a difference there is between the man of Tuesday’ (we met on that day) ‘and the man of Sunday; yet so many things remain to be done!’ I made an effort to find words to express to him the general interest which he excited. ‘I love to believe it,’ he replied, ‘I have long endeavoured to render myself worthy of it.’”

At nine o'clock on the evening of the 13th May, 1832, he had ceased to live, having reached only the age of 62, although belonging to a family remarkable for longevity.

At his own desire, Cuvier was buried in the cemetery of Père la Chaise, beneath the tombstone which covered the remains of his daughter. His funeral obsequies were attended by men of all ranks and opinions, who,

even in the midst of a raging pestilence, were eager to offer upon his tomb their last tribute of affection and admiration.

But it was not among the companions alone of his labours and his glory that this homage of love and sorrow was paid. In every corner of his native land, teeming with intellectual wealth, and splendid with immortal names, the loss of their naturalist, their legislator and their instructor, was bewailed as a national calamity. The remotest corners of his native land, and those in other countries, joined in the general lamentation; and within the temple of science itself it was felt that one of its chief pillars had fallen.

A history of Cuvier's labours in the domain of natural history would be the history of natural science in the first half of the nineteenth century. When he formed a system based on the invariable characters of anatomical structure instead of external resemblances, he discovered the true basis of a natural classification. He first introduced the division founded on different plans of structure of radiata, mollusca, articulata, and vertebrata; and this has been the basis of all modern improvements in zoology. The grand idea of Cuvier was to discover the plan of created beings by the study and comparison of the intimate structure of their organism. With him, comparative anatomy and zoology went hand-in-hand, and from their united facts he deduced the laws of a new science, that of fossil animal life, astonishing the world with the magnitude of his conceptions and the grandeur of his discoveries.

Linnæus had included in his class of worms all

animals which have not red blood—more than half of the animal kingdom. Cuvier's first researches were on this class of animals, which in 1795 he divided into the classes of his invertebrate series.

His very first observations in 1792 were on the anatomy of the common patella, certain dipterious insects, and crustaceans, in the "Journal d'Histoire Naturelle." In the same year he studied the structure of the mollusca, divided them into orders, and commenced a series of observations which resulted in his memoir on the history and anatomy of molluscs, published in 1817.

Comparative anatomy was the basis of Cuvier's zoology, and we find memoirs on this subject from 1795 to 1831. The "Leçons d'Anatomie Comparée" was but the preface of a more extended work, the plan of which he had already completed when death overtook him. Such as it is—a monument of vast labour—it has furnished materials for the development of this science, and has from its own stores enabled critics to point out unavoidable deficiencies. From a heap of dry, unconnected facts concerning the structure of animals, he obtained the general laws of organization, the limit of variation in each organ, the marked influence of some upon the general system, the subordination of many, and the co-existence or incompatibility of others. Among the prominent points are: the development of the teeth, the structure of the larynx of birds, of the nasal fossæ and organs of hearing in cetaceans, and of the respiratory organs in the perennibranchiate amphibia; the comparison of the brain in the verte-

brata, and the relation of its development to the intelligence; the respiration, animal heat, muscular force, sensory and digestive systems of these animals. For this treatise he received one of the decennial prizes instituted by Napoleon in 1810.

Cuvier in his scientific labours stated positively only that which he knew from personal observation, and therefore early directed his attention to collecting objects of natural history. The great collection at the Jardin des Plantes, made chiefly through his own exertions, contributed the materials of which he made such remarkable use. This collection was also necessary for the determination of fossil species, which he began to investigate while living in Normandy.

In 1796 appeared his treatise on the skeletons of the megalonyx and megatherium, and on the skulls of fossil bears from the caverns of Gaylenreuth. From this period till 1812 he contributed many papers on fossil bones, the most important of which were afterwards published under the title of "Recherches sur les Ossements Fossiles."

Deposits of molluses and other marine animals had long been known to exist at great distances from and heights above the sea, and were attributed to the Deluge. Large bones discovered in caverns or dug from the earth had given rise to traditions of the existence of giants in the early ages; and even philosophers regarded the fossil impressions in the rocks and the shells in the ground as accidental freaks of nature. Bernard Palissy, an unlettered potter, discovered the animal

origin and former existence of these objects, and although he defied the learned men of the sixteenth century to disprove his statement, it was not until the end of the seventeenth that his ideas met with a scientific recognition.

Founded on these now acknowledged facts, many theories, all more or less fanciful, were successively adopted, and abounded until the middle of the eighteenth century, when more rational views began to prevail, and the study of fossils to excite that attention which, in the hands of Cuvier, resulted in establishing many of the laws of geology and palæontology. The bones of the giant *teutobochus* had been long since recognized as those of elephants; the skeleton of the supposed antediluvian became under the eye of Cuvier that of a gigantic aquatic salamander. The fact of ancient creations of animals, entirely distinct from the present species and long since exterminated, was set at rest by the comparison of fossil and living animals by Cuvier.

In his first notes on fossil elephants, in 1800, he announced his views on extinct animals and commenced a series of observations unparalleled in the annals of science for brilliancy and profound insight into natural laws. With him a bone, or even a portion of one, was sufficient for the restoration of a fossil animal which he had never seen, simply from the principle of the unchangeable relations of organs.

He made several epochs of creation. The first comprised the molluscs, fishes, and monstrous reptiles; the second the anaplotherium and palæotherium, the

singular pachyderms of the neighbourhood of Paris; the third the mammoth, mastodon, gigantic sloths, &c.; then came a fourth, the age of man and the present creation. Anterior to the first epoch was a period in which no organic life, either animal or vegetable, existed on the earth. To Cuvier was principally due the discovery and exploration of the *terra incognita* of remote ages.

In 1817 was published the "Règne Animal," which has served as the basis for subsequent zoological classifications. The last great work of Cuvier, which he undertook in conjunction with Valenciennes, is the "Histoire Naturelle des Poissons." This contains the application of his principles of classification to class of fish. Linnæus had determined about 500 species, Lapécède 1,500. The title of this book implies its magnitude. It is "Natural History of Fishes, Containing more than 5,000 Species of these Animals, Described after Nature and Distributed according to their Affinities, with Observations on their Anatomy, and Critical Researches on their Nomenclature, Ancient as well as Modern."

Besides the "Report on the Progress of the Physical Sciences," undertaken at the request of Napoleon. Cuvier displayed the extent of his acquirements by his reports before the Institute, on meteorology and natural philosophy, in general chemistry and physics, mineralogy and geology, botany, anatomy, and physiology, zoology, travels connected with natural science, medicine, surgery, and other subjects.

He contributed many articles on natural history to

the "Dictionnaire des Sciences Naturelles." Prominent among these is the one on "Nature," in which he combats the mataphysical systems of pantheism or plurality of gods, and refers everything to the wisdom and goodness of an Almighty Creator.

Cuvier had a deeply religious nature, and his researches into science only intensified his veneration for the great Author of all things.

His language, both written and spoken, was clear, forcible, precise, and animated, frequently rising to the highest eloquence. The benignity and noble expression of his countenance were remarkable.

In private life he was kind, affable, and ready to communicate information. He had the greatest love for order and regularity, and rarely allowed himself to be disturbed during the hours set aside for study, but during his hours of audience he was accessible to everybody.

With his other accomplishments he was an expert draughtsman, and many of his plates were drawn by himself. He left a large collection of designs intended to illustrate his unfinished work on comparative anatomy.

The disinterestedness of Cuvier's character is shown not only by the acts of his life, but by the small fortune he left at his death, which was only about £5,000 and a library which cost him a similar sum. The latter was purchased by government and given to various institutions, principally to the "Jardin des Plantes."

When we consider the number of offices he held, and the duties which he conscientiously performed, any one

of which after his death was sufficient for a man of great talent, and some of which could not be as completely filled, we are able to form some idea of the varied acquirements, the unceasing industry, the wonderful memory, and the transcendent ability of Cuvier.

By universal consent he is regarded as one of the best of men, most brilliant of writers, soundest of thinkers, most far-sighted of philosophers, purest of statesmen, and may with every reason be classed among the greatest naturalists of modern times.





BUFFON.



GEORGE LOUIS LE CLERC, afterwards Count Buffon, the celebrated French naturalist, was born at Montbard, in Burgundy, September 7, 1707—the same year in which Linnæus was born. His father was a councillor of parliament of Dijon. It was the wish of his father that Buffon, with a view to qualify himself for the magistracy, should adopt

the profession of the law. This, however, had no charms for the latter, and his father quickly observed that astronomy and mathematics were likely to become the chief objects of his son's study. He wisely allowed him to follow the path which he had chosen, and he became so interested in geometry that some of his biographers assert, that while his youthful companions were at their sports he was generally to be found in some retired corner, poring over his pocket copy of



Buffon.

Euclid with a fervour equal to that displayed by Parson Adams for his *Æschylus*.

Such a mode of spending leisure hours, which otherwise would have been those of play, brought forth its fruits in due season, and many stories were current that he had anticipated Newton in some of his discoveries, but that he had withheld his claim, observing that people were not obliged to accept the assertion. These statements, in the light of the present day, should be received with reserve, for, to leave dates out of the question, it cannot be denied that vanity was certainly not absent as an ingredient in the character of young Buffon.

When he was about twenty years of age he made the acquaintance of Lord Kingston and his tutor, both of whom he met at Dijon. This soon ripened into friendship, and he arranged to travel through Italy in their company. The tutor appears to have been possessed of high scientific attainments, and his pupil at the same time a ready partner in his pleasures. While in Italy he received intelligence of the death of his mother, a lady of considerable intelligence. This event placed him in possession of a large income, nearly £12,000 a year, and from this time onward his life was a completely independent one, and he was enabled to devote himself entirely to his scientific pursuits.

On his return to Montbard, he, on account of some private entanglement, found it necessary to leave the place for a brief period, and he accordingly went to Paris, and visited England. He did not settle on his estate "for good" until he had reached twenty-five.

On returning to Montbard, however, he resolutely pursued his studies, and as it may not be uninteresting to those who think life was not given to us to be passed in mere frivolities, to know how Buffon passed his time, we select the following from a modern biographer. There is every reason to conclude that the history of one day was to a large extent similar to that of all the others, generally speaking, throughout a period of fifty years:—

“After he was dressed he dictated letters and regulated his domestic affairs, and at six o’clock he retired to his studies at the pavilion called the Tower of St. Louis. This pavilion was situated at the extremity of the garden, and the only furniture which it contained were a large wooden *secrétaire* and an arm-chair. No books or pictures relieved the naked appearance of the apartment, or distracted the thoughts of the learned possessor. The entrance was by green folding-doors; the walls were painted green, and the interior had the appearance of a chapel, on account of the elevation of the roof. Within this was another cabinet, where Buffon resided the greater part of the year, owing to the coldness of the other apartment, and in this room he wrote the greater number of his works. It was a small square building, situated on the side of a terrace, and was ornamented with drawings of birds and insects. Prince Henry of Prussia called it the “cradle of natural history,” and Rousseau, before he entered it, used to fall on his knees and kiss the threshold. At nine o’clock Buffon usually took an hour’s rest, and his breakfast, which consisted of a piece of bread and two glasses of wine, was brought to his

pavilion. When he had written two hours after breakfast, he returned to the house. At dinner he spent a considerable portion of time, and indulged in all the gaieties and trifles which occurred at the table. After dinner he slept an hour in his room, afterwards took a walk, and during the rest of the evening, he either conversed with his family or guests, or sat at his desk examining his papers. At nine o'clock he went to bed.

This kind of life he passed for fifty years; and to one who expressed his astonishment at his great reputation he replied, "Have not I spent fifty years at my desk?"

During all this long period of time he was indefatigable in his application, was extremely fond of study, and yet in his early days, felt the inconveniences of indolence. To an old friend he once said: "I was a great lover of my bed in my youth. My poor Joseph" (a servant who lived with him more than sixty years) "assisted me greatly to conquer that propensity. I promised him a crown every time he roused me at six. The next morning he did not fail to do his duty, but I repulsed him; he came the morning after, and I threatened to turn him out of the room. 'You have gained nothing, Joseph,' I said to him at noon; 'you know not how to manage me; think only of my promise, and don't listen to my threats.' The next morning he fulfilled my wishes, by forcing me to rise in spite of my ill-humour; and every succeeding day he was indemnified for my cross temper when I awoke, by my thanks and a crown. Indeed, I owe to Joseph ten or twelve volumes of my works."

In pursuing this course of living, study and regimen,

there can be no doubt that Buffon prolonged his life, notwithstanding the pangs from a painful disease from which he suffered.

The longevity of Buffon's family was somewhat remarkable, his father lived to the age of ninety-three, and his grandfather was eighty-seven when he died. Concerning the elevation of Buffon to the aristocracy of France, we may be permitted to refer to an incident which significantly marks the brutality and ignorance of the French people under the Reign of Terror. The only son left by Buffon was murdered only fifteen days before the fall of Robespierre. It might have been thought that the sacrifice of the son would have satisfied the bloodthirsty cravings of the Parisian mob; but no, the body and memory of the father whom the nation had honoured at his death were not secure. During the great storm which darkened the political horizon of Europe, the remains of the illustrious zoologist were torn from the grave, the lead in which his coffin was encased was plundered, and the monument which the son had erected to his memory was razed to the ground.

Before proceeding to give an account of the works of Buffon, we shall mention a few particulars relating to his person and character. His figure was noble and manly, and his countenance, even in advanced age and during the periods when he suffered great physical pain, was calm and placid, and exhibited traces of singular intelligence. Vanity, however, which seemed to have been his predominant passion, extended even to his person and to all his exterior ornaments. He was particularly fond of having his hair neatly dressed, and for

this purpose he employed a fashionable hair-cutter, who operated upon him twice and sometimes three times a day. To his dress he was particularly attentive, and took great pleasure in appearing on Sundays before the peasantry of Montbard in gold-laced clothes. He encouraged his attendants to relate to him every gossiping story which they heard. His vanity betrayed itself on a variety of occasions in relation to his literary performances, which were often the subjects of his discourse and even of his commendation. When he was recommending the perusal of the best works in every department of taste and science, he would sometimes add with singular presumption and self-confidence, "Capital works are scarce; I know but five great geniuses, Newton, Bacon, Leibnitz, Montesquieu, and myself."

He was in the habit of reciting to those who visited him, whole pages of his compositions, for he seemed to have them almost all by heart. Notwithstanding, however, his vanity, he listened to objections, entered into a discussion of them, and surrendered his own opinion to that of others when his judgment was convinced. He expressed himself with rapture concerning the pleasures accruing from study, and he declared his preference of the writings to the conversations of learned men, which almost always disappointed him, and therefore he voluntarily secluded himself from society with such, and in company was fond of trifling and was not at all times gentlemanly in his conversation. He maintained an extensive correspondence with several persons of rank and eminence. But his vanity was

perpetually recurring, particularly towards the close of his career. He frequently said that he had no fear of death, and that the hope of immortal renown was the most powerful of death-bed consolations.

Buffon, during the greater part of his life, was highly respected in all Europe, and it is said that during the war, 1755—1762, whenever the captains of English privateers found in their prizes any boxes addressed to Comte de Buffon (and many were addressed to him from every part of the world), they immediately forwarded them to Paris unopened—a mark of reverence for genius which ought not to remain unrecorded.

But I took great pains in forming the style of his writings, and as composition was to him a difficult task he repeatedly revised his works before he published them. Such was his attention to style that he could not bear the least deviation from accuracy and propriety in the use of language.

“The style,” said he, “is the man. Our poets have no style; they are coerced by the rules of metre, which makes slaves of them.”

To this circumstance it was perhaps owing that he abandoned poetry, which he attempted in his youth, and restricted himself to prose. Such was Buffon’s regard to fame, that he destroyed every paper which he thought useless or unfinished, and thus preserved his reputation from being destroyed by posthumous publications.

Of the free sentiments which Buffon had imbibed with regard to religion his works afford ample evi-

dence. They sufficiently indicate his attachment to the system of materialism, and some of his remarks respecting religion and the Creator were of such a nature as would greatly pain a sensitive mind. To quote these remarks would do no good in the present instance. He did not attempt to argue the want of proof as to a divine power. He simply treated all such matters with great contempt. Here again it is probable that his excessive vanity led him into giving utterance to language which he did not sincerely feel.

Buffon's literary career began with a series of translations. On his return to France from his tour in Italy, he translated into French two English works — the "Vegetable Statics" of Dr. Hales, and Newton's "Treatise on Fluxions." These translations, and the prefaces which he attached to them, were the first essays which, as it were, revealed him to himself, for from this time forth he quitted not the path of research into which his genius had led him. He wrote successively several papers upon geometry, physics, and other subjects, which opened for him the doors of the Académie des Sciences, into which body he was elected at the early age of twenty-six. In the year 1739 he was appointed to an important post in the Jardin des Plantes. The almost accidental circumstances which led to the appointment of Buffon to the position are deserving of mention as affording another illustration of the truth of the old axiom, that great events frequently spring from trifling causes.

The Jardin des Plantes answers to our Zoological

Gardens and the Botanical Gardens at Kew combined, and for years they had been under the care of the first physician to the king. This physician was indifferent to the science of botany; he had neglected the garden, which had consequently fallen into such a state of decay as to attract the attention of government. An inquiry into the management having been instituted, it was finally determined that the superintendence of the chief physician should be abolished, and the direction of the garden being deemed worthy of special and continuous attention, the post was conferred on a M. Dufay, a man of learning and science. After occupying the post for some years he was taken seriously ill, and a friend said to him, "Buffon is the only man enabled by his strength of character to continue the work of regeneration begun by you"; and Dufay himself signed the application that Buffon should be appointed, and from that period dates the development of the garden.

Assured of the royal favour, and safe in popular esteem, Buffon found himself unlimited in means and uncontrolled in scheme. He purchased houses, lands, collections. He pulled down, rebuilt, enlarged, reorganized. The king threw open to him the public treasury, and of this princely credit Buffon made ample and unshrinking use, guarding, however, at the same time, against unpractical and visionary projects.

In 1744, Buffon first published his "Theory of the Earth," which was included in his comprehensive and most celebrated work, "Natural History, General and Particular." which commenced in 1749 and was com-

pleted in 1767, extending to no fewer than fifteen different volumes. To these, supplements were afterwards added equal to several more volumes. In the anatomical portion of this work, the author had the assistance of M. D'Aubenton, but in all the other departments Buffon himself displays his learning, genius and eloquence, and he also indulges his fancy in exploring and delineating the whole economy of nature. He begins with a theory of the earth, which, as well as the other planets, he supposes to have been originally a mass of liquefied matter, dashed out of the body of the sun by the violent illapse of a comet. He then covers it with ocean, from which he forms strata by deposition, and mountains by the flux and reflux of the tide. Subterraneous fires, eruptions, and earthquakes produce other changes, and the world we now inhabit is but the ruins of a former world. In his account of the population of the earth with living creatures, he investigates the analogies between vegetable and animal life, and in explaining the mystery of animal generation, he allows ample range to his imagination in a variety of hypotheses and conjectures.

Buffon's natural history of animals commences with that of man, whom he traces from the cradle to the grave, through the development and maturation of his bodily organs and mental powers, the nature and operation of his senses, and the several varieties of his species, introducing and intermixing in the research many curious discussions. He then investigates the nature of brute animals in general, and marks the distinction between them and man by

denying them a soul and a memory, properly so called, and making all their actions to spring from external impressions.

In a supplementary volume published in 1776, Buffon added the history and figures of several new animals, with valuable additions to most of those described in the original work, together with a most ingenious dissertation on mules.

Disdaining the arrangements of systematic naturalists, Buffon has rejected all the received principles of classification, and has thrown his subjects into groups. Not content with deviating from established modes of distribution, he ridicules the authors of systematic arrangements, and particularly Linnæus, whose zeal and labours in investigating and classing natural objects entitle him to the highest praise.

It is hardly necessary to remark that Buffon adapted his style to the particular subjects of his discussion. Whilst the mere enumeration of facts, or descriptions of the figure, dimensions, and colours of animals, admit of no other ornament than that of perspicuity, topics of philosophy and argument require a higher and more figurative expression. Of these different species of writing the works of Buffon afford numerous examples. It has also been noted that his style occasionally rises above the level of his subject, and this is particularly the case when he is painting in glowing colours the manners and habits of the lion, the horse, the elephant, and others of his favourite subjects. By the indulgence of this passion for high painting, he has frequently

been betrayed into a deviation from the limits of simple truth, and has been led to wander into the regions of fancy. In particular and minute observation he excels, and by his indefatigable researches he made a most valuable addition to the treasure of authenticated facts. But at the same time it cannot be disputed that Buffon was occasionally misled by an undue attachment to theory, as well as by the ambition of distinguished eloquence.

Of what Buffon calls the "method" of his natural history, his own description is so curious, and in a sense "unmethodical" as compared with previous systems, but is yet so full and explicit, that it is a valuable lesson in itself. He imagines a man who, having forgotten all things, wakes up afresh to a sight of the objects which surround him; he places this man in a country where animals, birds, fishes, plants, and minerals are presented successively before him. "Soon," he says, "this man will begin to form a general idea of animated matter; he will easily distinguish it from inanimate matter, and in a very brief space of time he will readily distinguish animated matter from vegetable matter, and will naturally arrive at this first grand division—animal, vegetable, and mineral; and he will also have gained a clear idea of these three great objects, so different from each other—earth, air, and water; he will be enabled in a little time to form a particular idea of the animals which inhabit the earth, of those which exist in the water, and those which rise into the air, and consequently he will

easily form for himself this second division—quadrupeds, fishes, birds; and the same in the vegetable kingdom, with trees and plants, he will very readily distinguish them, whether by their height, substance, or general appearance.” The following is what he says on this matter:—

“This is what the simple inspection must necessarily give him, and what, with very slight attention, he cannot fail in recognising; this is also what we ought to regard as real, and respect as a division given by Nature herself. Afterwards, let us put ourselves in the place of this man, or let us suppose that he has acquired the same amount of knowledge and experience as we ourselves possess, he will come to judge the objects of natural history by their relation with himself; those which are the most necessary, the most useful to him, will hold the first place. For example, he will give the preference in the order of animals to the dog, the ox, &c., and he will always be better acquainted with those which will be the most familiar to him, and afterwards he will occupy himself with those which, without being familiar, still inhabit the same localities, and the same climate, as the deer tribe, the hare, and all wild animals, and it will not be until he has acquired a thorough knowledge of all these animals that his curiosity will lead him to the research of those inhabiting foreign climates, as the elephant, the dromedary, &c. The same process will be gone through with regard to fishes, birds, insects, shells, minerals, and in fact, all the other productions of nature; he will study them in proportion

to the utility he may be enabled to derive from them ; he will consider them in measure as they present themselves more familiarly to his eyes ; and he will arrange them in his mind relatively to this order of his knowledge, because such is, in fact, the order in which he has acquired them, and according to which it is necessary he should preserve them. This order, the most natural of all, is that which we have believed it our duty to adopt. Our method is not more mysterious than the one we have just seen.”

On reading this quotation we cannot but wonder when we perceive to what lengths prejudice or prepossession for a favourite doctrine may lead an author, and when the period at which Buffon wrote these remarks is taken into consideration, surprise will increase. When he wrote the foregoing more than half a century had elapsed since Ray and Tournefort had published their great works on method ; the ideas of Bernard de Jussieu had begun to spread, and Linnæus had given to the world his “*Fundamenta Botanica*,” the first germ of a new philosophy of the science.

After the completion of his history of quadrupeds in 1767, Buffon was interrupted in the progress of his labours by a severe illness, and therefore the two first volumes of his “*History of Birds*” did not appear till the year 1771. In the composition of the greatest part of these he was indebted to the labours of M. Gulneau de Montbeillard, who adhered so closely to Buffon’s mode of thinking and of expression that the public could not perceive any difference between the style of writing of the two. The four subsequent

volumes were the joint production of both writers, and each author prefixed his name to his own articles. The three remaining volumes were written by Buffon himself, with the assistance of the Abbé Bexon, who formed the nomenclature, drew up most of the descriptions, and communicated several important hints.

It was in the preparation of this that Buffon's peculiar system of method which he pursued in the first portion of his work, and of which we have already spoken, began to undergo a change. As he advanced with his work, he conformed himself more and more to the ideas, and by the ideas to the language, of the naturalists. He felt more and more the necessity of ranging objects according to their affinities, and as Cuvier has well remarked, "On reaching his history of birds, he tacitly submitted himself to the necessity under which we all are, of classifying our ideas in order to our obtaining a clear representative of the whole."

We may add that he did not wait till then. When, after having described one after the other, and without any methodical aim, the horse, ass, ox, sheep, goat, pig, dog, cat, in fact all the domestic animals, he proceeds to the wild animals, more than once, and evidently designedly so, he places together kindred species. For instance, he places deer near the roebuck, the polecat near the marten. On coming to the monkeys he places them all together, and even distributes them by distinct groups according to very good characters. But it certainly is above all in his "History of Birds," that, as Cuvier remarks, his march becomes really and scientifically methodical.

“In place,” says Buffon himself, “of treating birds one by one, that is to say, by distinct and separate species, I will unite them several together in one genus.” And this he does, for to each principal species, or that which he takes as a type, he adjoins all the species, whether of our own or foreign climates, which agree with it ; by these means he forms regular groups, families and genera, and he almost always respects the great and true characteristics.

When we speak, then, of the ideas of Buffon regarding method, we must take into consideration the epoch in which he held them, and, if we may so express ourselves, their date. No man, perhaps, more constantly modified his thoughts than Buffon, because no man more constantly elaborated them. An example of this is before us—he commenced his labours by comparatively ridiculing method, and he ended by striking out and pursuing a very good one of his own.

When Buffon commenced his great work he was no more an anatomist than he was a zoologist ; he became a zoologist later, but never an anatomist, strictly speaking ; and yet, on the one hand, he did much for anatomy, and on the other, he owed much to it. Buffon is the first who ever joined the anatomical, that is to say the interior, description to the exterior description of the species. He it was who called and inspired his friend and fellow-labourer Daubenton, and by his hands laid the first foundations of comparative anatomy, and perhaps he understood better than Daubenton himself all the bearings of the science.

In 1774 Buffon began to publish a supplement to his

Natural History, consisting of the "History of Minerals." These supplemental volumes, of which the fifth appeared in 1778, contain many curious and valuable experiments, as well as much theory, too much of it, however, too lax for the rigour of modern science. The concluding volume may be considered as a kind of philosophical romance. It comprehends what the author fancifully denominates the "Epochs of Nature," or those great changes in the state of the earth which he supposes to have successively resulted from his hypothesis of its original formation out of the sun. Of these epochs he enumerates seven, of which six are supposed to have been previous to the creation of man. In the description of these epochs, as to both their causes and effects, the author has indulged the sport of fancy, and formed a sort of fairy tale, which he rendered both instructive and amusing.

After he had completed his "History of Minerals," Buffon had formed a design of composing a "History of Vegetables," but this project was defeated by his death, which occurred, as already stated, on the 16th of April, 1778. His last words were spoken to his son, and were, "Never quit the path of honour and of virtue: it is the only way to be happy."

The works of Buffon, as a naturalist of the highest order have now been before the public for nearly a century. They have long ago passed the critical ordeal, and it is pretty generally acknowledged that while they contain much to praise, they are by no means undeserving of reproach. The sentiments which they promulgate, that have any relation to

religion, are extremely erroneous. He is a decided enemy to the doctrine of final causes, and he refers to unconscious nature every operation that ought to be attributed to a designing, kind, and ever benevolent Deity. He never

“Looks through nature, up to nature’s God,”

but perversely substitutes the effect for the cause, the outcome of the divinity for the divinity itself.

His labours, however, afford ample proofs of the power of genius, when directed by taste, and his particular descriptions of animals often exhibit an elegance of style which is to be met with in no other work of its kind. He had a mind well calculated for his task, and was indefatigable in his exertions to procure information. He spared no pains or expense to forward his undertaking nor any labour to complete it. Inattention and idleness were equally unknown to him. He never wasted the day in making resolutions for the morrow, but by constant and well-regulated exertion has left a striking example of what may be done by a proper division of our time, a due observance that no part of it passes unemployed, and a patient and steady perseverance in whatever we undertake.



SIR CHARLES LYELL, BART.



HIS distinguished Scottish geologist was born at Kinnordy, Forfarshire, November 14th, 1797. His father, Charles Lyell, was a man of literary and scientific pursuits, and it may fairly be inferred that the bent of the mind of his son was somewhat inclined by his own studies, he being an ardent botanist and also translator of the "Vita Nuova" and the "Convito" of Dante. The subject of our sketch was the eldest of ten children, two brothers and seven sisters, who all lived to grow up.

In a characteristic autobiography of his boyish days, which he wrote for the "instruction and amusement" of his wife, who was a daughter of the celebrated Leonard Horner, he thus records his entrance into life. Premising that his mother was a Yorkshire-woman, the daughter of a Mr. Thomas Smith, of Maker Hall, Swaledale, gifted with strong practical common-



Sir Charles Lyell, Bart.

sense, and a tender anxiety for the welfare of her numerous family, he goes on to say:—

“The front of heaven was *not* full of fiery shapes at my nativity, but it was a remarkable winter and spring, so warm that my mother slept all night with her bedroom windows open—which no doubt portended something remarkable in the bairn; and sure enough he was pronounced to be the loudest and most indefatigable squaller of all the brats in Angus, and while he kept others awake all night by his noise, thrived the while most vigorously. Besides this, it was more than twelve months before I cut a single tooth; and some old woman in Southampton, finding that my gums were very hard, and that I could eat very well, very considerably tried to persuade my mother that her first-born would *never have any teeth!*”

From his boyhood young Lyell had a strong inclination for natural history, especially entomology, a taste which he was able to cultivate in the New Forest, to which his parents and family had removed shortly after his birth. He was educated chiefly at Midhurst and then at Exeter College, Oxford, where he graduated B.A. in 1819, and M.A. in 1821. While at the University he had the advantage of listening to the geological lectures of Dr. Buckland, which first opened out to him a course of study which ultimately became the passion of his life. On taking his degree in 1821 he came to London and entered Lincoln's Inn, and in 1825, after a delay caused by a chronic weakness of the eyes, he was called to the bar, and was attached to the western circuit for about two years. In the

previous year, however, he made a tour on the Continent, which gave the bias to his mind, and led him to adopt the science of geology as a profession. During the whole of this time, though not neglecting the study of the law, he was slowly gravitating towards the life of a student of science. In 1819 he had been elected a member of the Linnæan and Geological Societies, communicating his first paper, "On the Marls of Forfarshire," to the latter society in 1822, and acting as one of the honorary secretaries in 1823. In that year he went to France, with introductions to Cuvier, Humboldt, and other men of science, and in 1824 made a geological tour in Scotland in company with Dr. Buckland.

Soon after the opening of King's College, London, he was appointed Lecturer on Geology; and the discourses which he delivered in this capacity were of so original and philosophical a character as to impress his pupils with respect for the then young branch of science, the rapid growth of which was being watched by many with feelings of contempt on the one hand and fear and jealousy on the other.

In 1826 he was elected a fellow of the Royal Society, from which in later years he received both the Copley and Royal medals; and in 1827 he finally abandoned the legal profession and devoted himself entirely to geology.

Before his appointment as Lecturer on Geology at King's College, however, Lyell's active mind had been busy in drawing out the plan of his famous work on the "Principles of Geology," the first volume of which

appeared in 1830, the second in 1832, and the third in 1833; but before the work was completed, a second edition of the earlier volumes was called for and produced. The subsidiary title, "An Attempt to Explain the Former Changes of the Earth's Surface by Reference to Causes now in Operation," gives the keynote of the task to which Lyell devoted his life, and in pursuance of which he made geological tours over large portions of the Continent, and in later years to Madeira and to the United States and Canada.

Now that geology has become an established science, and to show the difficulties which it had to encounter before it was admitted as one at all, and also to prove the soundness of the premises upon which Lyell based his opinions, we cannot do better than give the opening paragraphs of the work just mentioned. We quote from the first edition, published by John Murray, two volumes 8vo, 1830. The work has neither preface nor introduction, but boldly commences at Chapter I. In it the author says:—

"Geology is the science which investigates the successive changes that have taken place in the organic and inorganic kingdoms of nature; it inquires into the causes of these changes, and the influence which they have exerted in modifying the surface and external surface of our planet.

"By these researches into the state of the earth and its inhabitants at former periods, we acquire a more perfect knowledge of its *present* condition, and more comprehensive views concerning the laws *now* governing its animate and inanimate productions. When we

study history, we obtain a more profound insight into human nature, by instituting a comparison between the present and former states of society. . . .

“Geology is intimately related to almost all the physical sciences, as is history to the moral. An historian should, if possible, be at once profoundly acquainted with ethics, politics, jurisprudence, the military art, theology; in a word, with all branches of knowledge whereby any insight into human affairs, or into the moral and intellectual nature of man, can be obtained. It would be no less desirable that a geologist should be well versed in chemistry, natural philosophy, mineralogy, zoology, comparative anatomy, botany—in short, in every science relating to organic and inorganic nature. With these accomplishments the historian and geologist would rarely fail to draw correct and philosophical conclusions from the various monuments transmitted to them of former occurrences. They would know to what combination of causes analogous effects were referable, and they would often be enabled to supply by inference, information concerning many events unrecorded in the defective archives of former ages. But the brief duration of human life, and our limited powers, are so far from permitting us to aspire to such extensive acquisitions, that excellence even in one department is within the reach of few, and those individuals most effectually promote the general progress who concentrate their thoughts on a limited portion of the field of inquiry. As it is necessary that the historian and the cultivators of moral and political science should reciprocally aid each other, so the

geologist and those who study natural history or physics stand in equal need of mutual assistance. A comparative anatomist may derive some accession of knowledge from the bare inspection of the remains of an extinct quadruped, but the relie throws much greater light upon his own science, when he is informed to what relative era it belonged, what plants and animals were its contemporaries, in what degree of latitude it once existed, and other historical details. A fossil shell may interest a conchologist, though he be ignorant of the locality from which it came; but it will be of more value when he learns with what other species it was associated, whether they were marine or fresh-water, whether the strata containing them were at a certain elevation above the sea, and what relative position they held in regard to other groups of strata, with many other particulars determinable by an experienced geologist alone. On the other hand, the skill of the comparative anatomist and conchologist are often indispensable to those engaged in geological research, although it will rarely happen that the geologist will himself combine these different qualifications in his own person.

“Some remains of former organic beings, like the ancient temple, statue, or picture, may have both their intrinsic and their historical value, while there are others which can never be expected to attract attention for their own sake. A painter, sculptor, or architect would often neglect many curious relics of antiquity as devoid of beauty and uninteresting with relation to their own art, however illustrative

of refinement in some ancient nation. It has therefore been found desirable that the antiquary should unite his labours to those of the historian, and similar co-operation has become necessary in geology. The field of inquiry in living nature being inexhaustible, the zoologist and botanist can rarely be induced to sacrifice time in exploring the imperfect remains of lost species of animals and plants, while those still existing afford constant matter of novelty. They must entertain a desire of promoting geology by such investigations, and some knowledge of its objects must guide and direct their studies. According to the different opportunities, tastes, and talents of individuals, they may employ themselves in collecting particular kinds of minerals, rocks, or organic remains, and these, when well examined and explained, afford data to the geologist, as do coins, medals, and inscriptions to the historian.

“It was long ere the distinct nature and legitimate objects of geology were fully recognized, and it was at first confounded with many other branches of inquiry, just as the limits of history, poetry, and mythology were ill defined in the infancy of civilization.”

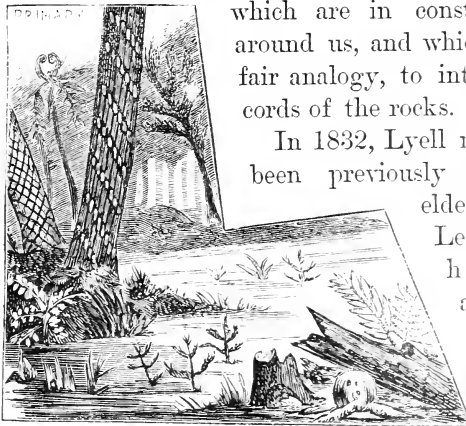
After the “Principles” had passed through five editions, a change was effected in the structure of the work, certain chapters on geology, strictly so called, being separated and reproduced in an amplified form under the title of the “Elements of Geology,” whilst the remainder retained its old title.* Much of this may

* Between 1830 and 1872 eleven editions of this remarkable work were issued, “each so much enriched,

be attributed to Lyell's intimacy with the late Sir Roderick Murchison, a journey with whom, taken in 1828, was especially fruitful in results. This alone "gave rise to two distinct papers on the volcanic district of Auvergne and the Tertiary formations of Aix-en-Provence; but it was apparently while examining Signor Bonelli's collection of Tertiary shells at Turin, and subsequently when (after parting with Murchison) he studied the marine remains of the Tertiary rocks of Ischia and Sicily, that Lyell conceived the idea of dividing the Tertiaries into three or four principal groups, characterized by the proportion of recent to extinct species of shells. To these groups, after consulting Dr. Whewell as to the best nomenclature, he gave the names now universally adopted—Eocene (*dawn of recent*), Miocene (*less of recent*), and Pliocene (*more of recent*) Upper and Lower; and with the assistance of M. Deshayes, who had arrived by independent researches at very similar views, he drew up a table of shells in illustration of this classification."

In the "Elements," therefore, he described those monuments of ancient changes through which the earth and its inhabitants have passed, whilst in the "Principles" he confined himself to the study of those forces

says a writer in the "Encyclopædia Britannica," "with new material and the results of riper thought as to form a complete history of the progress of geology during that interval. Only a few days before his death Sir Charles finished revising the twelfth edition, which appeared in 1876."



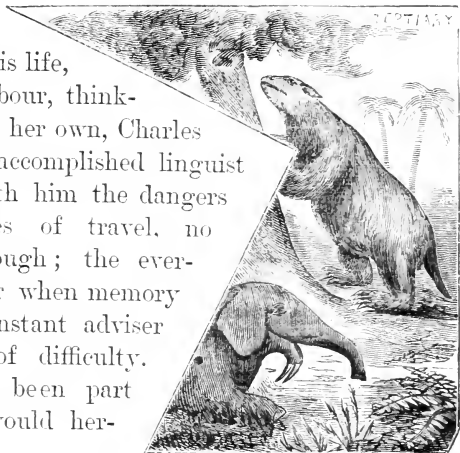
which are in constant operation around us, and which help us, by fair analogy, to interpret the records of the rocks.

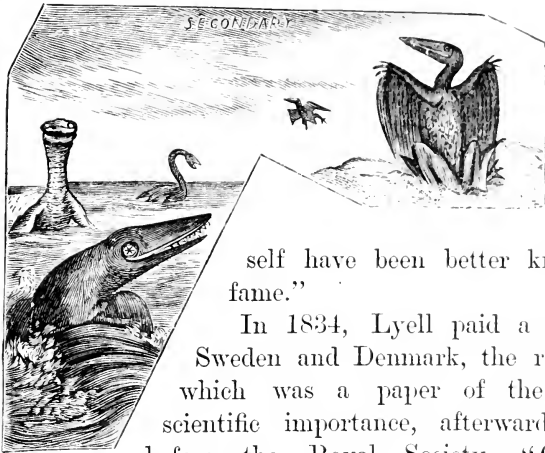
In 1832, Lyell married, as has been previously stated, Mary, eldest daughter of Leonard Horner, his "friend and teacher."

Knowledge writes, "Many have felt the

charms of the presence of Miss Horner; many have felt the influence of the soul that shone out in her face; but few know how much science directly owes

to her. In the companion of his life, sharing his labour, thinking his success her own, Charles Lyell had an accomplished linguist who braved with him the dangers and difficulties of travel, no matter how rough; the ever-ready prompter when memory failed, the constant adviser in all cases of difficulty. Had she not been part of him, she would her-

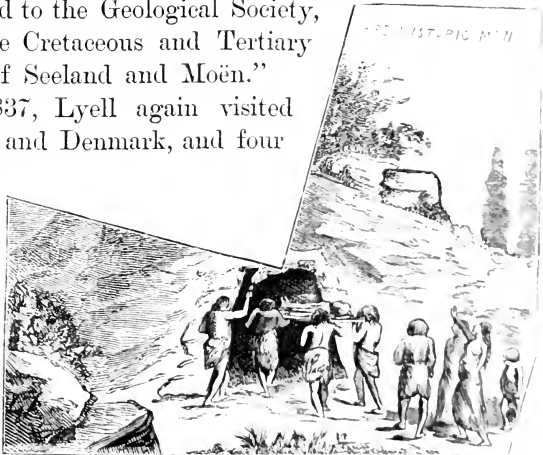




self have been better known to fame."

In 1834, Lyell paid a visit to Sweden and Denmark, the result of which was a paper of the utmost scientific importance, afterwards read before the Royal Society, "On the Proofs of the Gradual Rising of Land in Certain Parts of Sweden," and another, presented to the Geological Society, "On the Cretaceous and Tertiary Strata of Seeland and Moën."

In 1837, Lyell again visited Norway and Denmark, and four



years afterwards he spent upwards of twelve months in the United States of America, Canada, and Nova Scotia. This last journey, together with a second one to America in 1845, when he visited Boston, Philadelphia, New Orleans, and the alluvial plains of the Mississippi, gave rise, not only to numerous original papers, but also to the publication of two works not exclusively geological, "Travels in North America" (1845), and "A Second Visit to the United States" (1849).

Concerning the first of these two works, a writer in the "Edinburgh Review" says:— "These volumes exhibit in a narrow compass more of the bright side of the American character and institutions than we have discovered in the panegyrics of the most ardent democrats who have visited the land of liberty. This effect is produced not only by the hopeful, good-humoured, and unaffected tone in which the excellent writer relates his adventures; the occurrences themselves tell their own favourable story."

Referring to the same work, the "North American Review," the critical authority of the United States, says:— "Although only a small part of these volumes is made up from the materials of an ordinary book of travels, yet as such it is none the worse because the author came to inspect American rocks rather than American manners. The remarks he does offer are so sensible and discriminating, so evidently thrown out by one who possesses that rare knowledge—how to observe, and who thinks for himself, that we only regret they are so few and cursory, and are a little provoked when

he cuts short his observations upon the current topics of the day, and falls to 'napping the chuckie stanes' again."

Commenting on the "Second Visit," another authority of the time states:—

"We know of no books of modern travels so full of agreeable and useful reading, so pregnant with instruction respecting the geology and physical geography of America, and so liberal and candid in their judgments on all the social, political, and religious questions which now everywhere agitate the public mind. There is no object too low for our author's notice, and none too high for his grasp. Whatever warms the heart of the philanthropist, or excites the zeal of the missionary, or perplexes the genius of the statesman, or exercises the intellect of the sage, calls forth all his powers of observation, and rouses all his energies of thought. The condition of the criminal and the slave, the educational instruction of the ignorant, the moral and religious training of the people, the amelioration of the condition of the poor, and the equalization of the political rights, are all advocated with that earnestness and talent which seldom fail to advance the object at which they aim."

Besides these transatlantic journeys Lyell undertook numerous geological excursions at different times to all parts of Great Britain and Ireland, also to Germany, Spain, Belgium, Switzerland, Madeira, and Teneriffe. These latter islands he visited in company with Mr. George Hartung, of Königsberg, and together they

accumulated much valuable evidence on the age and deposition of lava-beds, and the formation of volcanic cones. He also revisited Sicily in 1858, when he made such observations upon the structure of Etna as entirely refuted the theory of "craters of elevation," upheld by Von Such and Elie de Beaumont.

In the month of September, 1848, Lyell received the honour of knighthood. This was done principally at the solicitation of Lord Lansdowne, who in a letter to Lyell, dated September 11th, says:—"I have thought it on consideration so fit in the distinguished situation you occupy, and with your scientific reputation, that you should receive the distinction of knighthood, that I took it upon myself to mention the subject to the Queen, and I have her Majesty's authority to state that she will most willingly confer it upon you, and she understands that is without any solicitation on your part."

In 1863 Sir Charles published a most important work, which took a large proportion of the public very much by surprise, and creating as it did the sensation of the season in the literature of science. This was the "Geological Evidences of the Antiquity of Man, with Remarks on Theories of the Origin of Species by Variation." In it the author brought forward a great amount of research with regard to prehistoric times. He had previously opposed the doctrine of development, but in this remarkable work he gave his adhesion to Darwin on the origin of species. A fourth edition of this truly scientific work, enlarged and greatly improved, appeared in 1873.

The "Antiquity of Man" marks a turning-point in public opinion upon the much-vexed question of the duration of the human race upon the earth. An able writer thus writes of it in the "Annual Register" for 1863:—

"Within the last few years the attention of geologists has been called to discoveries of flint implements and other vestiges of humanity in strata containing the bones of extinct animals, such as elephants and rhinoceroses, which had long been supposed to belong to an epoch preceding the appearance of man upon the earth. It is many years since these phenomena have been noticed, and individual geologists have drawn conclusions from their attributing a greater antiquity to man than the six thousand years commonly allowed. Philosophical caution, however, prevented the great body of scientific men from going over to this opinion, until lately, when Mr. Prestwich, an eminent geologist, and Mr. John Evans, a member of the Society of Antiquaries, examined the gravel and sand pits at Abbeville and Amiens, and the collection of M. Boucher de Perthes, which that far-sighted *savant* had long been forming, of objects discovered in those localities. The result was the expression of a conviction that the flint tools found in these pits had been deposited in the gravel beds at their first formation, and not subsequently introduced, and the conclusion followed that man existed previous to the formation of these strata.

"Many other prior discoveries of human bones and remains in caves, in conjunction with those of elephants,

hyænas, and other extinct animals, were now reconsidered, and a large body of facts, hitherto slighted as inconclusive, was brought into view. Sir Charles Lyell's work reviews the facts and considers their bearing, introducing also a discussion of the Darwinian hypothesis, and a summary of the recent controversy on the relation of the brain of man to that of the quadrumana. The tardiness which geologists have shown to embrace results which now seem so firmly established, and the materials for arriving at which have long been at hand, is a remarkable instance of scientific caution, not to call it a strong prepossession in favour of an assumed theory. The question must now be considered as settled, to the extent that a far greater antiquity must be assigned to man than has hitherto been believed. How much greater that antiquity may be than the indications at present discovered show, remains for further inquiry."

In 1864 Sir Charles Lyell was created a baronet, when the honour was conferred him as President at the British Association, at Bath.

His services to the science of geology were now universally acknowledged, both at home and abroad, and he was a member of nearly every American and Continental scientific society.

During the latter years of his life, his sight, always weak, failed him altogether, and he became very feeble up to the time of his death, which took place on February 22, 1875, he being then in his seventy-eighth year.

This melancholy event, although not unexpected, was

rendered more so by a family bereavement which occurred only a fortnight before in the sudden death of his brother, Colonel Lyell, who had been almost daily with Sir Charles for a considerable period prior to his own unexpected and fatal illness.

Dr. Hooker, President of the Royal Society (afterwards Sir Joseph Hooker, C.B.), wrote to his sister, Miss Lyell, on the day of his death:—

“I have just heard the distressing news, and can hardly yet say how much I feel it. My loved, my best friend, for well nigh forty years of my life. To me the blank is fearful, for it never will, never can, be filled up. The most generous sharer of my own and my family’s hopes, joys, and sorrows, whose affection for me was truly that of a father and brother combined. I feel deeply for you all; two such blows to you and your sisters, and to Mrs. Lyell (his sister-in-law) surely hardly ever came so rapidly, so remorselessly, as it were.

“I have just headed a memorial to Dean Stanley, praying that he may be interred in Westminster Abbey, the Dean having volunteered his hearty assent, and every influence in his power to have it granted. Sir Edward Ryan first told me of it, and now joins with me in the earnest hope that you will allow this tribute to be paid to the most philosophical and influential geologist that ever lived, and one of the very best of men.”

The following is the memorial referred to, and in pursuance of which the body of Sir Charles Lyell was placed in Westminster Abbey:—

“ We, the undersigned Fellows of the Royal, the Geological, and the Linnæan Societies, respectfully pray that the remains of Sir Charles Lyell may be interred in Westminster Abbey. For upwards of half a century he has exercised a most important influence on the progress of geological science, and for the last twenty-five years he has been the most prominent geologist in the world, equally eminent for the extent of his labours and the breadth of his philosophical views.”

The prayer of the memorial was immediately granted, and the funeral was attended by an immense concourse of public men, all his personal friends; for by young and old the veteran master of geology was deeply loved and revered.

The late Dean Stanley conducted the service, and on the following Sunday he also preached a funeral sermon in the Abbey, from which we make the following extract :—

“ Of him who is thus laid to rest, if of any one of our time, it may be said that he followed truth with a zeal as sanctified as ever fired the soul of a missionary, and with a humility as child-like as ever subdued the mind of a simple scholar. For discovering, confirming, rectifying his conclusions, there was no journey too distant to undertake. Never did he think of his own fame or name in comparison of the scientific results which he sought to establish. From early youth to extreme old age it was to him a solemn religious duty to be incessantly learning, constantly growing, fearlessly correcting his own mistakes, always ready to receive and reproduce from others that which he had not in

himself. Science and religion for him not only were not divorced, but were one and indivisible."

He was buried in the nave of the Abbey, where a gravestone of fossil marble from Derbyshire bears the following inscription:—

CHARLES LYELL,
BARONET, F.R.S.,

Author of

"The Principles of Geology."

Born at Kinnordy, in Forfarshire,

November 14, 1797.

Died in London,

February 22, 1875.

Throughout a Long and Laborious Life

He Sought the Means of Deciphering

The Fragmentary Records

Of the Earth's History,

In the Patient Investigation

Of the Present Order of Nature,

Enlarging the Boundaries of Knowledge,

And Leaving on Scientific Thought

An Enduring Influence.

"O Lord, How Great are Thy Works,

And Thy Thoughts are very Deep."

Psalm xcii. 5.

A marble bust by Theed, after the original one by Gibson, is placed near the grave.

Miss Frances Power Cobbe, who had frequent

opportunities of seeing Sir Charles Lyell in his latter years, thus records her impressions:—

“The last of the elder generation of our great men of science, Sir Charles Lyell leaves behind him the memory of a character almost ideally representing what such men should be; so free from egotism, vanity, or jealousy; so ready to be pleased with every innocent jest or amusement; so ready to listen patiently to the remarks of those infinitely below his mental calibre; and withal so affectionate and tender of heart, that no child could be more simple: and, on the other hand, so filled with reverent enthusiasm for the glory and grandeur of the universe, to whose study he devoted himself; and so ready to open his mind to each new truth, that no man could better deserve the title of a true philosopher. Nor did his philosophy, though it released him from some of the bonds of early prejudice, ever lead him to renounce those highest truths to which the lesser ones of science lead up. It was his frequent observation that religious sentiment deserved as much confidence as any other faculty of our nature; and in full faith and hope in God and immortality, he passed calmly into the dark valley of age and death.”

To summarize the life and labours of Sir Charles Lyell in their relationship to the science of geology would be much the same thing as sketching the development of the modern British school of the same science during more than the past half century. The task to which he devoted his greatest powers and noblest energies was that of establishing the principles of the

science of geology on a sound and philosophical basis. His guiding star pointed to the uniformity of the laws of nature—a belief which led him to argue that by studying the changes which are being wrought upon the surface of the earth by the silent action of forces now in operation, we put ourselves in possession of a key to the interpretation of those ancient records which it is the special business of the geologist to decipher.

Prior to the death of Sir Charles Lyell, nearly all the first generation of geologists had passed away—Buckland, Conybeare, Sedgwick, Murchison, Phillips. From the advent of the science knowledge has widened in every direction; larger views of nature and the universe have gained belief everywhere, and geology has fully shared in the general expansion. In this process it cannot be questioned that no one had a greater share than Sir Charles Lyell, for he was much more than a mere geologist. He had a well-trained and scientific mind, which enabled him to take large views of every subject presented to his intellect, to see its various bearings and its points of alliance or contrast with other ranges of thought. All his work was done leisurely, fully, and completely, in large books, and not in fragments of essays and papers; and every book was absolutely finished up to the point which knowledge had reached when he put it forth.

Sir Charles, in spite of his great age and pre-eminent scientific acquirements, was singularly open to fresh accessions of knowledge and fresh generalisations from the increasing store of facts; and it is no light testimony to the original soundness of his views,

that they have easily admitted an assimilation of all fresh discoveries and a re-adjustment to newly-accepted theories. He was not only a keen investigator of natural phenomena, he was also a shrewd observer of human nature, and his interesting travels in America are full of clever criticism and sagacious forecasts. His mind, always fresh and open to new impressions, by sympathy drew towards it and quickened the enthusiasm of all who studied nature. Had he done nothing himself, he would have helped science on by the warmth with which he hailed each new discovery. Professor Hughes says, "How many a young geologist has been braced up for new efforts by the encouraging words he heard from Sir Charles, and how many a one has felt exaggeration checked, and the faculty of seeing things as they are, strengthened by a conversation with that keen sifter of the true from the false!"





SIR RODERICK J. MURCHISON.



THIS eminent geologist was born at Tarradale in Ross-shire, N.B., February 19, 1792. He was the eldest son of a gentleman of ancient Highland family, and was descended from a small clan or sept which for many generations lived in the west of the county, furnishing factors for some of the larger landholders, occupants of farms among the western sea-lochs, and even occasionally a parish minister, a doctor, or a schoolmaster. His father Kenneth Murchison, educated as a medical man, acquired a competent fortune in India, and while still in the prime of life returned to Scotland, where marrying he purchased the estate of Tarradale, on which he settled for a few years as a resident Highland landlord. At the age of seven, young Murchison was sent to the Grammar School at Durham, where he remained for a period of six years, during which time

he may be said to have received the only systematic education he ever obtained. Being destined for the army, he was next sent to the University of Edinburgh for a few months, after which he was removed to the Royal Military College at Great Marlow. With not a little difficulty he succeeded in the rather indifferent examinations of the time, and in 1807, being then only fifteen years of age, he received a commission as ensign in the 36th Regiment of Infantry. He joined the army in the Peninsula under Lord Wellington, carried the colours of his regiment and was present at the actions of Roriera and Vimeiro, earning for himself the reputation of an able officer. Many years afterwards the Duke of Wellington said to him, "What, were you that chubby-faced boy who held up the colours when I halted the 36th after Vimeiro?" Subsequently under Sir John Moore, he took part in the retreat to Corunna, and took part in the final battle there. These six months of active service formed the only part of his military career in which he was exposed to the hardships and dangers of actual warfare. After serving in Spain and Portugal, he was removed to the staff of his uncle—Sir Alexander Mackenzie—in Sicily. He also served at the siege of Cadiz, and afterwards in Ireland as a captain in the Enniskillen, or 9th Dragoons. The defeat of Napoleon at Waterloo seeming to close the prospect of advancement in the army, Murchison, after eight years of service, quitted the military profession. In the year 1815, he married the daughter of General Francis Hugonen, of Nursted House, Hampshire, and spent some time on the Continent, particularly in Italy,



Sir Roderick J. Murchison.

where the cultivated tastes of his wife were of signal influence in instigating and developing his future pursuits. He threw himself with all the natural enthusiasm of his nature into the study of antiquities and art, and for the first time in his life enjoyed the pleasure of intellectual knowledge.

Of this period of his life, Professor Geikie, in his biography of Murchison, tells a circumstance which, while doubtless authentic, is nevertheless very surprising. Having given up one fixed employment, the ex-captain of dragoons began to look out for another. After the fashion of that day, he seriously thought of becoming a clergyman. "I saw," he wrote himself, "that my wife had been brought up to look after the poor, was a good botanist, enjoyed a garden, and liked tranquillity; and as parsons then enjoyed a little hunting, shooting, and fishing, without being railed at, I thought I might slide into that sort of comfortable life." For those who knew Murchison in after years, it is almost impossible to grasp the idea that he *might* have become a country parson instead of a geologist. However, this was fortunately not to be. As already mentioned, the newly-married couple went abroad. This arrangement fell in admirably with the plans of Mrs. Murchison, who had sagaciously seen that her husband would be more likely to break off from his useless life at home if he were thrown among a new set of acquaintances and pursuits on the Continent. She resolved to approach him at first from the side of art. They posted slowly through France, examining the picture galleries *en route*, spending the summer in Switzerland and the winter in Genoa, whence

in the spring of 1817 they departed for Rome. By this time he had become a confirmed dilettante, and his copious notes on pictures and works of art show that he was most enthusiastic and active in his new-found occupation. His criticisms on the works of the great Italian masters alternate with observations on the Forum, the tomb of Cecilia Metella, the baths of Caracalla, and the Grotto of Egeria, and with anecdotes of Canova, whose acquaintance he made. In these two years he was sowing seed which would bear fruit afterwards. Through art he owed his first introduction to an intellectual life; it was not art which was to be his future stimulus, but it was for him the starting-point of a new career, and it was the first step in the direction of the work and of the honours which he was to achieve. Mrs. Murchison had gained the first victory in her campaign, but it was for a time obscured by intervening defeats.

On their return from Italy they discovered that the Tarradale Estate had been sold, and they had no alternative but to take up their abode in an old mansion at Barnard Castle. The only recreation for him here was in the sports of the field, into which Murchison threw himself with his usual indomitable energy. His wife endeavoured, but unsuccessfully, to direct his mind into the study of botany and mineralogy, and for some time he enjoyed the reputation of having the finest stud and being one of the hardest riders in the country. How this period of his life closed will be best told in his own words, written forty years afterwards.

“As time rolled on I got *blasé* and tired of all fox-hunting life. In the summer following the hunting

season of 1822—23, when revisiting my old friend Morritt of Rokeby, I fell in with Sir Humphry Davy, and experienced much gratification in his lively illustrations of great physical truths. As we shot partridges together in the morning, I perceived that a man might pursue philosophy without abandoning field sports; and Davy, seeing that I had already made observations on the Alps and Apennines, independently of my antiquarian rambles, encouraged me to come to London and *set to* at science, by attending at lectures on chemistry, &c. As my wife naturally backed up this advice, and Sir Humphry Davy said he would soon get me into the Royal Society, I was fairly and easily booked.”

The enthusiastic fox-hunter then abandoned sport, and cast in his lot with men of science.* He entered upon his new life by attending the lectures at the Royal Institution, among which was a course of geology. From the Institution named he was led to meetings of the Geological Society, “then held in little rooms in Bedford-street, Covent Garden; a society founded in 1807, and then composed of a small but most brilliant

* Sir Roderick used to tell an interesting anecdote of the beginning of his scientific career. He was attending the lectures of Dr. Brande, when one day the lecturer’s place was taken in his absence by a pale thin lad, his assistant, who gave the lecture and experiments in so admirable a manner as to be received at the end with a hearty round of applause. The name of the assistant was Michael Faraday, and this was his first public appearance.

body of orators and philosophers, and in which he was destined to take a most important part for the next half-century. Professor Sedgwick says that the "Geological Society of London was, in its early days, composed of robust, joyous, and independent spirits, who toiled well in the field, and did battle and cuffed opinions with much spirit and great good will; for they had one great object before them—the promotion of true knowledge—and not one of them was deeply committed to any system of opinions." The same author also speaks of "the joyous meetings, and of the generous, unselfish, and truth-loving spirit that glowed throughout the whole body."

Such was the peculiar condition of "geological science at the time, that a great work could be done by a man with a quick eye, a good judgment, a keen notion of what had already been done, and a stout pair of legs." Murchison possessed all these advantages, and in addition an orderly and methodical habit, which would have insured success in most walks in life.

Before proceeding further, let us briefly survey the position of geological science previous to this time. At the commencement of the present century British geologists were divided into two hostile parties, the one being composed of the followers of Hutton, of Edinburgh, and also known as Vulcanists or Plutonists; the others the followers of Werner, the eminent mineralogist of Frieberg, generally termed Neptunists.

Hutton's opinion was that the past history of the earth is to be accounted for by an appeal to existing causes, that the continents were first gradually destroyed

by aqueous denudation, and that out of their ruins were slowly accumulated new continents, to be elevated in their turn by violent convulsions. Thus there would be periods of repose alternating with periods of disturbance, one of each constituting a cycle of change. He held that the flow of the rivers, the dash of the rain, the destructive action of the frost, and all the other agents of changes going on at the present time, were the causes of those which have taken place in the earth, in all the time past of which evidence is before the geologist.

“I do not pretend,” wrote Hutton, “to describe the beginning of things; I take things such as I find them at present, and from these I reason with regard to that which must have been.” These views, adopted subsequently by Lyell and his followers, did not take into account either the whence or the whither, either the beginning or end of the earth. They constitute the essence of what Professor Huxley terms the uniformitarian doctrine; and be it remarked that this section of the Huttonians disbelieves in the doctrine of alternate periods of repose and convulsion, which is held by another section, termed by Professor Huxley the catastrophic.

On the other hand, Werner taught that the earth “had been originally covered by the ocean, in which the materials of the minerals were dissolved; but of this ocean he imagined that the various rocks were precipitated in the same order in which he found those of Saxony to lie. Hence, on the retirement of the ocean, certain universal formations spread over the

surface of the globe, and assumed at the surface various irregular shapes as they consolidated." The important principle which he enunciated was, that the rocks lay in a certain order, and that they therefore had been deposited at successive times.

When the chemical participation theory was rapidly passing away in favour of the Huttonian views, Murchison was abandoning his sporting proclivities, and bracing himself for the life of science, in which afterwards he so distinguished himself. The Wernerian theory had indeed received its defeat from the researches of William Smith, "the father of English geology," as he was called. His system of geological classification was rapidly applied to very nearly all the countries of Europe. Every year now tended to broaden the base of the infant science of geology, and multiplied its details. The rocks to which William Smith paid most attention were those now known as the Secondary, or Mesozoic rocks.

With regard to the strata newer than these, so far back as 1766, Gustavus Brauder had figured an admirable series of shells found in the Eocenes of Hampshire; and at the beginning of the present century in France the labours of Baron Cuvier, and others, had raised from the dead, so to speak, the extraordinary group of animals living in Eocene France. In Germany, Goldfuss had been eagerly working at the animals found in caves; and his success had induced Buckland to explore the hyæna den of Kirkdale, and to ransack the other caverns of this country. When the principle of the classification by fossils was fully

recognized, it was seen that the strata were divisible into three great groups characterized by certain persistent forms of animal and vegetable life, into Primary or Palæozoic, Secondary or Mesozoic, and Tertiary or Kainozoic. The fauna and flora of the first being much less like the productions now on the earth than the second, and each being defined from the other by great physical breaks, during which continents had been submerged, and the depths of the sea had become dry land.

It thus happened that when Murchison first applied himself to the study of geology as the science of his life, the Tertiary rocks were known to occupy the eastern parts of England as far as the chalk; the Secondary rocks extended over the whole area from the chalk downs westward to the line of the coal-measures; while the Primary swept in a broad band obliquely through England and into Wales, being represented by the coal-measures and "Old Red Sandstone." Below these lay a geological terra incognita, embracing the hilly districts of Wales and Cumberland and the Highlands of Scotland, and termed, for want of a better name, from its grey colour, Graywacke. It is obvious that in this direction Murchison might expect greater success than in any other, for the Tertiary strata required a knowledge of the living forms which he did not possess, and the Secondary were already explored.

"Engaged in the fascinating pursuit of the new science were heroes as noble and knightly as the fellowship of Arthur's Table Round. There was the eloquent, active, and humorous Buckland, fresh from

his caves, ready to pick a bone with any one, posting to and fro whenever he heard of any new find, and breaking the monotony of Oxford lectures by a ride across country with his students, or by stamping the memory of Oxford or Kimmeridge clay in their minds by leading them into quagmires. There were the eagle-eyed Sedgwick, full of enthusiasm and not less ready for the fray; Wollaston, stern in his search for truth; the cautious Warburton; the hasty Fitton; the critical Conybeare; the shrewd Leonard Horner, and others. They were men for the most part of wealth and position, and with them were associated the most distinguished philosophers of the time, Whewell, Davy, Stokes, and others. All these were men of wide and liberal minds, and naturally would open to Murchison the society for which he was by his own tastes peculiarly fitted. He could moreover follow his new pursuit without sacrificing his out-door exercises."*

He entered eagerly and yet with method into the career before him. He first set himself to master what books had to tell him of the rocks, and then he proceeded on a tour along the south coast with his wife, whom he left at Lyme Regis, to work quietly at the fossils. He got as far west as Cornwall, where he first saw the rocks of which he and Sedgwick were afterwards to be the historians. On his return he wrote his first scientific paper on the district immediately round Nursted, which proved his

* Edinburgh Review, 1875.

capacity as an observer. Soon afterwards he was elected one of the honorary secretaries of the Geological Society. "Lyell, being then a law student with chambers in the Temple, could only devote a portion of his time to our science, and was glad to make way as secretary for one who, like myself, had nothing else to do but think and dream of geology, and work hard to get on in my new vocation." In 1826 he was elected Fellow of the Royal Society, not on account of his scientific work, but because he was an independent gentleman with scientific tastes, and with time and money to gratify them. In those days the Royal Society was almost as much an aristocratic as a scientific distinction. "This," he wrote afterwards, "was perhaps the happiest period of my life. I had shaken off the vanities of the fashionable world to a good extent, was less anxious to know titled folks and leading sportsmen, was free of all the care and expense of a stable full of horses, and had taken to a career in which excitement in the field carried with it occupation, amusement, and possibly reputation."

The summer following was spent in settling the age of the coal-field of Brora, for which he prepared himself by an extensive survey of the Yorkshire Oolites, during which he made the friendship of Professor Phillips, and his uncle William Smith. In after years, Phillips often recurred to their first meeting, and told how enthusiastic and methodical Murchison was, and how in their boating and walking he was led to see clearly, "that strata must alone be

identified with their fossils." Being possessed with this knowledge, he had no difficulty in proving, in a comprehensive Memoir, that the coal of Brora belongs to the same Oolitic group of rocks as those of Yorkshire. To his meeting with Phillips and Smith may fairly be assigned his first mastery of the principles of geological classification, which he afterwards used with such important results in the interpretation of the Silurian, Devonian, and Permian rocks.

By the time Murchison had been three years at work as a practical geologist, he had not only mastered what was then known of the rocks of Great Britain, but he had added to the general stock of knowledge by his expeditions into Scotland. He had become one of the leading members of the Geological Society, and one of the most ardent and promising geologists of the day. It was only natural that he should turn his newly-acquired knowledge into account by similar expeditions on the Continent. Accordingly, in the winter of 1828-29, we find him arranging the first of the journeys which occupied him for the best part of the next three years, the ground explored extending through France to the shores of the Adriatic on the one hand, and through Rhineland and Austria into Hungary on the other. In this expedition he was accompanied a certain way by Lyell. In June following, Murchison, together with Professor Sedgwick again visited the twisted and broken strata which compose the Alps. They passed by Bonn and Gottingen, then through Dresden to the Carinthian Alps, where they were received by the Archduke John, "the most scien-

tific prince in Europe.” From thence they visited Switzerland, ultimately returning to record their observations in four Memoirs, which “are models of rapid generalization and of keen and quick observation.”

It was not long before Murchison again set out for the Continent, partly to compare the fossils which he had obtained in Germany with those of the French collections, and partly “to frequent the society of scientific friends.” From Humboldt, who then happened to be in Paris, he gained a considerable amount of information as to the geological structure of the districts which were the scenes of his travels.

In 1831 he was elected President of the Geological Society, a dignity which he honourably earned by the hard work of previous years. The debates of the Society during his term of office were among the most brilliant in London, and the audiences which attended them included most of the eminent men of science in London.

He was no sooner installed as President, than, at the instigation of Buckland, he set himself to work on the solution of the problem offered by the rocks which cover the greater part of Wales, then known obscurely as Graywacke. The important results of this resolution are now matters of scientific history. In his expedition he laid under contribution stores of knowledge accumulated by local observers, which were freely placed at his service. To one of these—the Rev. T. T. Lewis, of Aymestry—he acknowledged himself indebted “for much of his knowledge of the rocks and fossils of the Upper Silurian Series, for that gentleman had already

made out the arrangement of the rocks in this district, and recognized their characteristic fossils before Murchison had begun to study the subject."

The seven succeeding years were chiefly devoted to the mapping of these newly-classified rocks, for which Murchison proposed the name of Silurian, from his having first of all worked at them in the country of the Silures,* and in 1838 the results of his labours appeared in a magnificent volume entitled "The Silurian System," and which contained, in addition to almost learned and comprehensive text, a geological map and a series of plates of fossils, which at once established his reputation as one of the first geologists in Europe.

In this great work the author freely availed himself of the assistance of his friends, and in it the especial knowledge required for the interpretation and description of the fossil remains was contributed by the leading palæontologists of the day. It was a complete work, designed and carried out in the most methodical manner, exactly what might have been expected from such an energetic man of business as the author was. Agassiz described the fishes, Sowerby and Lonsdale the corals and shells, Broderip and Phillips, Milne-Edwards, and others, assisted in various important

* Siluria means simply, a district on the borders of England and Wales, which was formerly inhabited by a tribe of ancient Britons, whom Roman authors speak of under the name of Silures. Shropshire and Herefordshire, Montgomeryshire and Radnorshire, may be taken as the main part of this district.

departments. The work was appropriately dedicated to his friend and fellow-traveller Sedgwick. Before the publication of this truly great work, these Graywacke rocks had generally been looked upon as a geological chaos, but Murchison had now succeeded in mapping off the order of their upper divisions, and in revealing to his readers a series of changes in the fossil groups of life, analogous to those which William Smith had proved to exist in the secondary rocks. He had, moreover, traced the flows of lava and basalt, and the sheet of volcanic ash to the sites from which they were poured forth; and he had proved to what a thickness the volcanic detritus had spread over the ancient Silurian Sea.

Before the "Silurian System" was well out of his hands, Murchison, in conjunction with Sedgwick, determined to make out the history of the rocks of Devonshire and Cornwall. Their labours resulted in the proof that the massive slate rocks of the south-west of England, and the irregular fossil coral reefs at Torquay, Plymouth, and elsewhere, formed part of a group of strata below the coal measures and later than the Silurians.

After a hasty, but most successful tour in France, Murchison determined to employ himself in an undertaking more serious than anything he had previously done. This was to strike across the Russian empire to the Urals, and his plan was welcomed by the Russian Government with promises of support. In the spring of 1841, accompanied by M. de Verneuil, he bent his steps towards the Neva. The Emperor himself took

considerable interest in the expedition, and from that time forward was numbered amongst Murchison's illustrious friends. On being joined by Count von Keyserling, deputed by the Russian Government to attach himself to the expedition, they spent the next five months in exploring Central and Southern Russia, a work full of incident, the results of which were subsequently detailed in "Russia and the Ural Mountains"; a costly and elaborate work, in which are treated not only the rocks of Russia, but also those of Scandinavia. His scientific merit was, through the production of this work, now so thoroughly recognized abroad, that it could no longer be ignored at home; and accordingly in 1846 he received the honour of knighthood in consideration of his distinguished services. Three years later he obtained the still higher honour of the Copley Medal, from the Royal Society.

Murchison had now done the main geological work of his life. There only remained to him the consolidation of his conquests, and the application of his classification to other regions. In 1854 the first octavo edition of his popular work, "Siluria," appeared, in which, as before, he availed himself of the co-operation of all the best men in their respective departments.

For thirty years Sir Roderick had been free from the cares of public duty. It was now his fate to be appointed Director-general of the Geological Survey of Great Britain, and of the School of Mines; a position which he held till his death, to the great advantage of the public service. The energy and

business-like qualities of the new director-general at once made themselves felt in the order and method by which the survey was conducted, as well as in the uniform system of the publication of the memoirs, and the arrangement of the collections. His high social position and personal influence with the Ministry, gave a prestige to the department which it had not possessed before, and prevented its dismemberment, or absorption into South Kensington. By his rare tact he kept it during the whole of his reign distinctively a school for geology and mining.

We must now refer to Murchison's connection with the British Association. As head of the geological and geographical sections, as general secretary, and ultimately as president, he continued to fill a foremost place in it till the end of his life.

His name also will ever be associated with the history of exploration in Africa. While Livingstone, Burton, Speke, Grant, Baker, and others were pursuing their investigations, shut out from civilization, and thrown upon their own resources, he in England was ever looking after their interests with anxious solicitude. Even when the wilds of Africa had closed over Livingstone for years, he was the last to lose heart in the success of the enterprise.

After the death of his wife in 1869, there is very little left to record of Sir Roderick Murchison. He had reaped a rich harvest of honours. In 1860 he was elected Corresponding Member of the French Institute; in 1864 he received the Wollaston Medal, and in 1866 he was created a baronet. In 1870 he founded, in

conjunction with the Government, the Murchison Professorship of Geology in the University of Edinburgh, and in the winter of that year was struck down by paralysis. He rallied, however, sufficiently to prepare his last Address in 1871, but as the autumn came round he gradually became worse, until he could no longer speak, and on the 22nd of October he quietly and almost imperceptibly passed away, at the ripe age of seventy-nine.

The honours which Sir Roderick Murchison won are a great testimony to the scientific enlightenment of the age. We have crowned SCIENCE Queen, and all her servants form her court and wear the title she bestows. And truly, a scientific man earns his honours more nobly, and wears them more honourably, than those who win them in political controversy or on the field of battle. In future years he will be known as one of the pioneers of that new order of renown which is won by fruitful service rather than by destructive deeds. The scientific theories which he was unable to admit gained a rapid victory over those to which he clung; he was therefore rather the great authority of a transition time than the prophet of the future; but the very fact that, after a long life spent in the service of science, he went to his grave as full of honours as of years, is one more illustrious proof that science has, in latter days, opened for every one who chooses to study it, a new way to fame and historical renown.

*A BOOK FOR ALL INTERESTED IN THE EDUCATION OF THE
PEOPLE.*

FREE PUBLIC LIBRARIES,

THEIR ORGANISATION,
USES AND MANAGEMENT.

With Illustrations of Free Library Buildings, Ground Plans,
&c. &c.

BY

THOMAS GREENWOOD, F.R.G.S.

LONDON:
SIMPKIN, MARSHALL, & CO.

—
1886.

Price 2s. 6d. ; by Post, 2s. 9d.

A TOUR IN THE STATES AND CANADA : OUT AND HOME IN SIX WEEKS.

AN ILLUSTRATED AND COMPREHENSIVE GUIDE.

Showing how all the Principal Sight in the Chief Cities of the States and Canada may be seen with great comfort and a very small outlay of either money or time.

By THOMAS GREENWOOD, F.R.G.S.

London : L. UPCOTT GILL, 170 STRAND, W.C.

What the PRESS says :—

The Times, July 21, 1883.

The traveller who has only six weeks to spare will find some useful hints in Mr. Greenwood's unpretentious "Tour in the States and Canada ; Out and Home in Six Weeks."

The Christian World, May 31, 1883.

Visits to Europe are now accepted as well nigh a necessary part of the training of our transatlantic cousins ; but there is no corresponding rush of Europeans to the New World, although there is much unquestionably to be gained from such a visit, in the infusion of new ideas, well calculated to rid our countrymen of narrow insular prejudices. With a view to removing some of the barriers which stand in the way of such intercourse, Mr. Thomas Greenwood, whose experience well qualifies him for the task, supplies under the title "A Tour in the States and Canada," some practical directions, which will be found very serviceable to those whose engagements compel them to limit their holiday excursion to a period of six weeks. The volume is published by Mr. Upcott Gill, and it would be difficult to find a work in which an equal amount of trustworthy information is brought together in so readable a style.

London Daily Chronicle, June 12, 1883.

A plain matter-of-fact narrative ; but one that will prove of essential service to anyone wishing to make a similar tour. No point seems to be overlooked, and the author touches on many phases of industrial life in America, as well as those of a holiday character.

Scotsman, June 26, 1883.

Mr. Greenwood's "Tour in the States and Canada," should be found of considerable use to those who propose to imitate his example, and spend six weeks in travelling through the Eastern States and Canada. Mr. Greenwood, by presenting this information in a condensed and convenient form, gives the intending traveller an opportunity of "posting himself up" beforehand, and has besides prepared tables of tariffs and distances that will be found of much use.

Nottingham Daily Guardian, June 22, 1883.

Contains a good deal of valuable information. The *raison d'être* of the little volume is to show business men with six weeks to spare that the time cannot be more profitably spent than in a visit to the New World, and this he well succeeds in doing.

Bristol Daily Times and Mirror, June 2, 1883.

This is the result of a "run over to the States" for six weeks, and the name of the author is a sufficient guarantee that while so running he has read much, or at any rate has succeeded in getting together a quantity of valuable and interesting information, for the benefit of those who may follow him. The New World, as he says, is naturally a source of great interest to most English people, but in the way of the many, who would like to see for themselves the state of things across the Atlantic, there are many obstacles, in the removal of which this little book materially assists.

Publisher's Circular, July 16, 1883.

It is a comprehensive and well-arranged little book, full of really useful matter.

North Cheshire Herald, June 2, 1883.

One of the most interesting publications we have perused for some time is on the above subject, from the pen of Mr. Thomas Greenwood. Our readers have from time to time had an opportunity of judging with what felicity Mr. Greenwood enlists their interest, and retains their attention until he has disposed of his subject. So it will be found in "A Tour in the States and Canada," being a practical guide to seeing the leading centres of those places in six weeks—an accomplishment plainly demonstrated by the author.

Bath Herald, June 16, 1883.

These are days of rapid movement, and the writer of this neat little volume undertakes to show his readers how to enjoy a six weeks' scamper through the States and Canada. He very carefully describes the hotel system of America, and the expenses a tourist will

be put to, the things to be seen in the various towns, and gives a number of hints which will be useful to the English visitor. He is quite right as to the interest and advantage of a trip to America, however brief, and his pages will do as much to smooth difficulties out of the way of the traveller as any volume we know.

Cook's Excursionist and Tourist Advertiser, July 2, 1883.

It is impossible to read the pages in Mr. Greenwood's book without being struck at the pleasant, easy style in which they are written, and, at the same time, at the care and the accuracy with which such important details as statistics are dealt with, where they come in the path of the writer. Altogether, those who contemplate taking a tour in the States will find this work an intelligent companion.

Literary World, July 6, 1883.

In this convenient little volume, the author endeavours to give practical and useful information to the intending and possible traveller.

Strofford and South Essex Advertiser, June 8, 1883.

In a sketch of a mere holiday-run over a vast tract of country we cannot expect a very profound study of the manners and customs of a people, but we may get a good deal of useful information conveyed in a readable style. In this respect Mr. Greenwood is decidedly successful.

Leamington Spa Courier, June 23, 1883.

This work is designed for tourists in the United States and Canada, and contains a large fund of information, on such subjects as prices, distances, routes, hotel and railway charges, which all persons visiting America for the first time will find exceedingly useful. So far as we are aware, much of the information here given was not previously accessible in a convenient form, and therefore the work merits special commendation. Most of the chief features of all the large towns and cities of America are described, and the scenery of the country on the chief railway routes is also touched upon. Altogether it is a very useful handbook, and intending visitors to America may consult it with advantage.

The British Trade Journal, June 1, 1883.

This is an intelligent record of a brief sojourn in Greater Britain. The author visited the leading cities in the States, kept his eyes and ears open, and gained a great deal of information, which he has put together in a compact form. The chapters dealing with the American manufacturing centres contain interesting matter.

The Warehouseman & Draper's Trade Journal, June 2, 1883.

In this little volume Mr. Greenwood has given the results of his experience during a brief holiday in the United States and Canada, and has done so in a form specially useful to those who may think of making a similar tour, as it contains a large amount of information presented in an easy style, and a very practical manner. The book is well worth reading by those who do not intend to cross the Atlantic.

The Country News and Chronicle (Stockport), June 8, 1883.

The work is written in a readable style, and contains in small compass a mass of interesting information for those who have not yet had a voyage across the Atlantic.

The Cabinet Maker, June 1, 1883.

A smart little volume . . . It gives a most pleasant account of the States and Canada as they present themselves to a "man on pleasure bent," who, by the way also "had a frugal mind." Mr. Greenwood has in this volume treated of things not usually observed by the ordinary tourist, and his work is the more valuable in consequence.

The Field, July 14, 1883.

New York, Boston, Montreal, Quebec, Ottawa, Toronto, Niagara, Buffalo, Cleveland, Detroit, Chicago, Cincinnati, and Louisville, St. Louis and Pittsburg, the Oil Regions, Richmond, Baltimore, Washington, Philadelphia, and several manufacturing centres are here in turn discussed in their superficial aspects, with advice on emigration, &c. The latter non-descriptive part will probably be found of some use to those who want to know everything before they start.

The Queen, July 7, 1883.

In a moderate-sized volume the writer narrates his experience in a recent "run over the States" giving his narrative that practical and suggestive turn which fits it to be taken in hand as a general guide by any who may be meditating the same trip. His observations on steamers, baggage, hotel life, railways, and kindred subjects are among the most useful features of the book, and he has instructive remarks to make concerning the principal cities and places visited or likely to be visited by the ordinary excursionist across the Atlantic.

The Colonies and India.

To a traveller who uses his eyes and exercises ordinary intelligence, as Mr. Greenwood evidently did, a run to the States is a matter of vast importance, for it gives opportunity for personal study of peoples and places, about which much that is wrong has been written, mixed with much that is right. We can only hope that some day, when the Canadian Pacific Railway is finished, Mr. Greenwood will tell us what there is to see on the way to New Westminster and Victoria, along the route of that railway.

736 GI

05/19/95

BR

41245

2112



