



Men of the Day, No. 33
"Natural Selection"

(From a cartoon that appeared in *Vanity Fair*, Sept. 30, 1871.)

THE EVOLUTION OF CHARLES DARWIN

By
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LONDON
GEORGE ALLEN & UNWIN LTD.
MUSEUM STREET

First published in Great Britain 1928

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Printed in Great Britain by Phototype Limited, Barnet, Herts.

To the memory of Sir Francis,
third son of Charles and Emma
Darwin, whose editing of his
father's letters makes it possible
to understand the evolution
of one of the greatest and noblest
characters that ever lived

Mr. Darwin's character was chiefly marked by a certain grand and cheerful simplicity, strangely and beautifully united with a deep and thoughtful wisdom, which, together with his illimitable kindness to others and complete forgetfulness of himself, made a combination as lovable as it was venerable. . . . No man ever passed away leaving behind him a greater void of enmity, or a depth of adoring friendship more profound.

— ROMANES

None have fought better, and none have been more fortunate, than Charles Darwin. He found a great truth trodden underfoot, reviled by bigots, and ridiculed by all the world; he lived long enough to see it, chiefly by his own efforts, irrefragably established in science, inseparably incorporated with the common thoughts of men, and only hated and feared by those who would revile, but dare not. What shall a man desire more than this?

— HUXLEY

As an explanation of evolution Darwin's ideas still hold the field to-day, and subsequent work has necessitated less modification of them than of those of his contemporaries in physics and chemistry. Just as physiology has found no case of interference with the order of nature as revealed by physics and chemistry, the study of evolution has brought to light no principle which cannot be observed in the experience of ordinary life and successfully submitted to the analysis of reason.

— J. B. S. HALDANE

P R E F A C E

DARWIN came to manhood as a failure and for the remainder of his life struggled against illness, yet conceivably no one more benefited mankind and revolutionized human thought, or lived a more exemplary life. How was this possible? How could he so triumph over weak human nature as to make his life a pattern of serenity and his work an ideal of scientific endeavor? Darwin himself could not have answered, for he did not understand himself; but he did open the door to life, and made such an understanding possible.

To understand Darwin is to understand human beings. That must be my justification for this book—an attempt to describe a unique personality as seen through the door he opened to all who have eyes to see and whose vision is not narrowed by prejudice or restricted by convention. When that ever-increasing army of observers has ceased to observe, life's secrets will have been bared and death will have lost its sting.

There were no secrets in Darwin's life. The material available for observing the evolution of his personality is enormous. His own published letters fill several volumes, and his published works exceed seven thousand pages. To these must be added an extraordi-

narily valuable autobiographical sketch which he prepared for his family when he sensed the interest that would inevitably be directed toward him after death. Books about Darwin and his works fill libraries. Those which I have drawn upon freely and to which I am especially indebted, in addition to Darwin's own works, are:

The Life and Letters of Charles Darwin. Edited by his son, Francis Darwin. 2 vols.

More Letters of Charles Darwin. Edited by his son, Francis Darwin. 2 vols.

A Century of Family Letters. Edited by his wife, Emma Darwin. 2 vols.

Life and Letters of Thomas Henry Huxley. By his son, Leonard Huxley. 2 vols.

Alfred Russel Wallace, Letters and Reminiscences. By James Marchant.

Charles Darwin and the Origin of Species. By Edward Bagnall Poulton.

Charles Darwin. Memorial Notices reprinted from *Nature*.

While the lines I have used from these books may not always be quoted with literal exactness, none, I believe, distorts the meaning of the author.

I am also greatly indebted to Sir Arthur Keith and to Major Leonard Darwin, son of Charles Darwin, for valued suggestions and advice.

GEORGE A. DORSEY.

New York City,
January, 1927.

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THE EVOLUTION OF
CHARLES DARWIN

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INTRODUCTION

THE EVOLUTION OF PERSONALITIES AND BELIEFS

IF ONE speaks of immortal geniuses, one must speak of Darwin; if one speaks of immortal discoveries, one must speak of Darwin; if one speaks of revolutions in the basic concepts of nature, one must speak of Darwin; and if one speaks of individual performances which have become part of human heritage and which have changed the course of all further human endeavor, one must speak of Darwin first. Therein is Darwin's greatness. He was unique in the character and scope of his personality and the extent to which he changed the beliefs of the civilized world.

Are "personalities" born, or do they grow naturally, evolve? Whence come "beliefs"—from a supernatural being, or do they grow naturally, evolve? And if personalities and beliefs grow or evolve, how? If personalities are born, what becomes of evolution? And if beliefs are inspired by a supernatural being, by whom and how? What is the nature of human heredity, what are the sources of human beliefs?

Confusion on these points is common and profound

and is responsible for short-sighted education and social injustice, and for the devastating and senseless conflict between "science" and "religion." More. Confusion on these points is fatal to an understanding of Darwin and his works, and hence to an understanding of human personalities and how they get their beliefs.

One hundred years ago (Darwin was then a student of medicine in Edinburgh) it was believed that human beings were descended from Adam and Eve, who, together with "heaven and earth and clouds full of water," were created "by the Trinity on October 23, 4004 B.C., at nine o'clock in the morning." The "authority" was the Book of Genesis, and the details just cited had been worked out by the eminent Hebrew scholar Dr. Lightfoot, Vice Chancellor of the University of Cambridge. It was further believed that while all human beings were of supernatural or Divine origin, they were cursed with original sin due to the Fall of Man caused by a serpent. Belief in the Creation and the Fall hung together, for without "creation" there could be no "original sin"—and without "original sin," in the words of Peter Martyr, "the promise of Christ would become void." In other words, there was no problem of the evolution of personalities or beliefs when Darwin was a boy. The real problem was to enforce beliefs and save souls.

Through the centuries of the Christian Era skeptics had arisen, only to have their lives snuffed out or their opinions damned. But when a joint paper by Darwin and Wallace was read before the Linnæan

Society on the night of July 1, 1858, a wedge was started which marks the beginning of a new era in the history of human discovery. The old era said: The Word is the word; the new: Whose word is the Word?

With the publication of Darwin's *Origin of Species* on November 24th of the following year, the wedge was driven home. The Church, the vested interest of the Word, stormed at the "fairy tale" and abused its author as a persecutor of Christianity. Gladstone declared that Darwin's work had relieved God of the labor of creation and discharged Him from governing the world! The great universities of England sought to remove the wedge. The president of Yale said he did not believe in evolution and the president of Princeton protested "against the arraying of probabilities against the clear evidence of the Scriptures."

The new era, conceived in 1858 and born in 1859, has amassed so much clear evidence of the fact of evolution that only the ignorant can doubt it. The problem now is not evolution but how evolution takes place: how do things, personalities such as human beings and beliefs evolve? And this problem remains within the realm of science and common sense when it has shown the inevitable and necessary sequence of events; the problem gets beyond science and common sense when it tries to explain that sequence in terms of cause and effect. No scientist knows *why* it gets dark when the sun goes down, nor anything about the *cause* of darkness—or of anything else; he does know that he cannot see when there is no light.

Darwin, for example, was a personality, a human being. No one knows why he evolved; it is known that the person we call Darwin was thus and so at any given time. And he can be described as he was at any given time in terms of antecedent factors. The problem is to ascertain which factors inevitably and necessarily preceded this or that form of his behavior.

We may distinguish, for convenience, three phases or aspects of his behavior—and we must inquire whether or not these three phases were necessarily related. Thus, at the age of sixteen he was studying medicine: was this because his father and his grandfather were doctors? Did he inherit a tendency or proneness to medicine? At the age of nineteen he was studying for the ministry: did he also inherit a tendency to be a clergyman, or was it because there was nothing else for him to do? At the age of twenty-two he was a waster, card player, sport, without serious interests: was this also because he was the third son of Robert Waring Darwin and Susannah Wedgwood? And how did it come about that within one short year he had changed from an “idle sporting man, which then seemed my probable destination,” into as serious and tireless an investigator of the secrets of nature as the world has ever known? Born that way, or because he was not “destined” to be an idle sporting man?

The modern name for destiny is heredity. But “heredity” merely conceals the problem by naming it.

We therefore begin with Darwin when he had no

personality and when even under the highest powered microscope he had no more individuality than any other of the countless millions of fertilized ova that have developed into human beings since Man evolved from Ape-man.

That fertilized ovum (Darwin at, say, May 8, 1808) had no more personality or apparent individuality than had another fertilized ovum which was to enter this world with Darwin on February 12, 1809, and be known to history as Abraham Lincoln. Neither heredity nor destiny gives us a scientific picture of Charles Darwin and Abraham Lincoln at any stage of their career as personalities, nor explains, for example, why it is that, long before Lincoln had expressed an opinion on slavery, Darwin had voiced his abhorrence of it.

Both Darwin and Lincoln were genetically related to two preëxistent human beings—each a chip from two old blocks. Each developed into a man with physical features more or less closely resembling those of his parents. Why not? Science knows of no reason why a chip should not grow into a resemblance of the parent blocks. Therein we have one phase or aspect of human behavior—the genetic.

Darwin and Lincoln throughout their lifetime from single-celled embryos to death lived by building up their bodies and renewing the worn-out parts from minute fragments of dead bodies of plants and animals. The energy transformed in these processes was obtained from the oxidation of carbon compounds. This is the second aspect of human behavior—the

vital or visceral; and different in no fundamental respect in Darwin and Lincoln, as embryos or as adults, from any other animal.

The visceral behavior differences between Darwin and Lincoln were due to differences in inherited visceral mechanisms and the ways or habits those mechanisms acquired after birth, and in the care taken of them by Darwin's and Lincoln's parents while they were young, and by Darwin's and Lincoln's motor and speech mechanisms when they had left the nest. And this introduces us to the third aspect of human behavior—the somatic or general bodily behavior and called psychologic, although science knows *psyche* only as a myth or ancient belief.

The connection between visceral and somatic behavior is profound, intimate, and unceasing, but no particular form of visceral or somatic behavior or instinct is known to be innately, inherently, and necessarily associated with any race or racial trait or any physical trait whatsoever. If Lincoln had had a black skin or woolly hair, he could not have been President; Darwin's nose almost cost him the opportunity of the voyage on the *Beagle*, and if his fingers had been webbed or his skin black he would not have been sent to Cambridge to study for the ministry.

In short, Darwin and Lincoln at birth can be assumed to have been normal infants of white-skinned parents. They both had a human heritage: certain visceral mechanisms fit for action; motor and speech mechanisms fit for nothing more than random, aim-

less, senseless actions. They were individuals at birth, but with little "individuality" and less "personality." They acquired individuality, personality—slowly at first, then more rapidly. And each acquired immortal fame.

Suppose that on February 12, 1809, some magician had made an instantaneous exchange of babies—dropped the new-born Abraham into Susannah's arms and the new-born Charles into Nancy's arms!

With Darwin's and Lincoln's birthright was the capacity to learn any way of somatic behavior that any human being had ever learned—provided, of course, that each was a normal new-born and came into this world with the usual complement of mechanisms for learning, and provided, of course, that, for example, a pair of bass vocal cords are not asked to learn to sing soprano or a lightweight expected to become champion of all weights. Absurdities and impossibilities can no more be expected of particular human beings than of particular motor cars.

Darwin and Lincoln were normal, average specimens of new-borns and had all the parts necessary for the learning of human behavior. Born without "knowledge," they learned; born without trained hands and voice, they learned to use both; born without specific fears, hates, or loves, they learned specific fears, hates, and loves; born hungry, they acquired specific appetites. When the sex hunger drove them, they acquired specific mates.

But what? What did Darwin learn to do with his hands and with his voice? What was he afraid of,

what did he hate, what did he love? In which direction did his hungers drive him? What were his appetites and his cravings, and how were they formed, what satisfied them, how were they satisfied?

Shall we solve these fundamental problems of somatic and visceral behavior by reference to genetic behavior? Can we describe Darwin, or any personality however great or small, in terms of germ-plasm or heredity? Or by merely uttering the word "evolution"? Or shall we think of "personality" as the aggregate of experiences and habits at any given time, and these against a specific background of social and material environment?

Visceral mechanisms from birth respond to certain ranges of vital stimuli and make vital responses. The motor and speech mechanisms learn to respond to stimuli which *seem* vital. The mechanism back of the "seem" is blind and deaf, although the "learning" may be through the eyes or ears. The "mechanism" is the conditioned reflex—perhaps the most important concept discovered since Darwin freed nature to the observation of curious eyes. Through that mechanism the stomach can be taught to heave at the sight of a worm, the fists to clench at the sound of a word, the entire nation to march to war at the nod of a head.

A study of Darwin's personality, then, at the age of six or sixteen or sixty, is a study of the organization of his habits—emotional (or visceral), manual, and verbal: the bent, direction, and nature of his emotional drives, and the habit formations in manual

and verbal mechanisms which satisfied or responded to these drives. What stimulated, what were his habitual responses?

To discover in a cadaver in an Edinburgh dissecting room what he was expected to discover in order to qualify for the practice of medicine was no stimulus to him to respond with all his vital energies, yet the impulse to discover the origin of species was stimulus enough to drive him to dissect half the animal and plant kingdoms. The idea of the practice of medicine did not fire him with zeal. The idea of preaching did not rouse him to act with might and main, or with his hands and voice. His bents had got their set in childhood—neither Edinburgh nor Cambridge, medicine man nor priest, lured him on.

Many a young man has failed in his own eyes and in his father's, as did Darwin, to get anything vital out of college: the college offered nothing for his vitals to gnaw on.

Stimulus and response are the keys to Darwin's life, as they are to the lives of all living organisms. The ways the various receiving organs and mechanisms receive stimuli and the ways the responding organs and mechanisms learn to respond to these stimuli whereby the organism as a whole is adjusted give us a clue to the behavior of the whole organism.

Darwin grew up in a so-called Christian household; he acquired certain beliefs. But those beliefs were not so loaded with conditioned fears that he was afraid to confront belief with a fact when he found it. If the "belief" did not measure up with the fact, so

much the worse for the belief. He was not afraid to observe—with eyes, nose, ears, tongue, and fingers. Many modern extensions and refinements of indifferent human sense organs were unknown in his day (one of his sons became a maker of scientific instruments!); the marvel is that he had eyes for everything and could see so far into so many things. He was not afraid to look!

Beliefs founded on fear, or which in the course of time come to be regarded with awe or held to have supernatural origin or Divine sanction, are passed on from generation to generation, from parents to children; they are accepted naïvely, unquestioningly; they even become fetishes, the Word, the Law. They cannot be questioned; their truth or validity is not open to doubt. Such beliefs die hard, for, backed as they are by public opinion, by higher authority, and by vested interests, they cannot be attacked openly or questioned with impunity. Hence the extraordinary resistance on the part of the ignorant, both within and without the Church, to the *Origin of Species*. It had been hard enough to square Genesis with the discoveries of Copernicus and of Galileo, but to accept Darwin's hypothesis that Man and all living beings were part of the process of evolution seemed to cut the very ground from under Man's feet: gone were his security and his sense of serenity. If Man also had evolved, the old magic which had compensated for all fears of death and destruction must go too.

Our interest here is not in the changes in belief

which necessarily followed from the acceptance of the hypothesis or law of evolution proposed by Darwin, but rather in the organization of individual habits of response to words.

Words are learned with varying amounts of emotional conditioning. Some words, as learned in childhood, carry heavy charges of explosive. One *must* not say the naughty word, but one *dare* not say certain words without risking body and soul. For millions of people the fires of "hell" were as real as was the fire in the kitchen stove, and were infinitely larger, hotter, and more lasting than the fires of the sun. Fear of such "fires" created in words prevented the motor mechanism from searching for them with eyes, ears, and nose.

Darwin himself grew up in a household which read and which was familiar with words in print. But it was also a tradition in that household that the fact that someone's verbal manipulation of the objective world had become recorded in print was no valid evidence that such verbalizations necessarily squared with the factual world which could be observed with human senses, or with any world which could be inferred from human observation. The printed page in Darwin's home carried no special sanctity, nor was the Word itself a fetish to be worshiped with fear and trembling. At least, all the evidence points that way, and Darwin's career is witness to the supposition.

Darwin, when a boy, often read a book called the *Wonders of the World*—and disputed with other boys about its veracity; but that book gave him a wish

“to travel in remote countries.” And travel he did. The immediate result was his *Journal of the Voyage of the Beagle*. That *Journal* was to be read forty-five years later by a boy on an Ohio farm—and was to impel him “to travel in remote countries” and change his beliefs.

Suppose Darwin’s uncle had not pleaded with the father that Charles be allowed to take that voyage on the *Beagle*, or that the *Beagle’s* captain had persisted in his first dislike of young Darwin because of the shape of his nose: there would have been no *Journal* and presumably no *Origin of Species*, and no Darwin—immortal genius, unique personality, and benefactor of mankind. On such slender threads hang genius and revolutions of beliefs.

The factors in the evolution of personalities and of beliefs are presumably finite, but they are inconceivably complex and incalculably numerous. We can never know all the factors that went into the making of the personality known as Darwin, or into the belief known as evolution. But enough is known of the factors which condition personalities, and of the mechanisms which become conditioned and the mechanism of conditioning, to furnish us the clues to an understanding of Darwin. It is known that Man can name the unknown and the unseen and describe the unknown and the unseen as though they were known from observation, and then accept such descriptions as facts and so adjust himself to such “facts” (beliefs) by manual or verbal responses that having eyes he need not look and having ears he need

not listen. When to "believe" is to be "saved," why question belief? If belief is current coin for knowledge, why trouble to investigate? In short, beliefs also can be investigated and can be brought within the realm of understanding.

But behind every human personality and behind every belief are infinitely complex mechanisms known as human beings. These mechanisms are driven: by fear, to flee; by hate, to kill; by love, to explore, to capture, to manipulate, embrace, and possess, with hands and voice. Why was it that beliefs which for ages had been accepted as axioms became for Darwin problems for investigation to which he devoted his life? The drive could not have been fear, for fear hides or flees; it could not have been hatred, for rage is blind and destructive. It must have been love. When the opportunity came, when the situation was right, love drove Darwin to manipulate the world. Under that drive he developed along specific lines and became the personality that he was. As a result of his manipulation he so described the world that the world believed it had evolved.

CHAPTER I

DARWIN'S MOTHER OPENED HIS EYES TO NATURE

I told another little boy that I could produce . . . which was of course a monstrous fable. I was much given to inventing deliberate falsehoods.

DARWIN'S AUTOBIOGRAPHY.

WHY does a boy of eight invent fabulous lies? Let Darwin himself answer: "for the sake of causing excitement"! The monstrous fable young Darwin invented caused so much excitement that the other "little boy" never forgot it, and when Darwin was dead and gone recalled it to his son Francis. But Darwin's version of that boyish fable as he recalled it nearly seventy years later, differs from the version of the other little boy recalled nearly seventy-five years later. Darwin says he told his playmate he could produce variously colored primroses by watering them with certain colored fluids; the playmate says that young Darwin brought a flower to school and told him that his mother had taught him how, by looking at the inside of the blossom, he could discover the plant's name!

Boys will be boys—unless they are idiots—and Darwin when a boy was a boy; and in that respect he never grew up. As Alfred Wallace said in reviewing one of Darwin's books, his restless curiosity as a child to know the "what for," the "why," and the

“how” of everything never abated its force. The real problem in human behavior is not why this or that man became a genius, but why there are not as many female as male geniuses, and why there are any morons.

Young Darwin “of course” did not know how to produce variously colored primroses by watering them, nor could he discover the name of a plant by looking at the inside of the blossom; but he could spend a lifetime in trying to find out—and did. Our business right here is to find out why he was driven to do this.

Was it because he had an inborn and constant instinct and habit of observing, as Bradford in his *Darwin* claims? Or was it because, like all other human beings, he was born without instincts and habits, but with the capacity to acquire habits and remain their constant slave as long as they satisfied his innate curiosity to explore the world, and as long as their performance gratified a deep-seated love and yielded satisfactory results? I maintain that in the second alternative we find the clue to Darwin's genius, and therein must be content to be an exception if Bradford is right in his statement that “all those who write about Darwin make this instinct [of observing] at least the foundation of his scientific eminence.”

To assume that Darwin had an “inborn and constant instinct and habit of observing” is too simple an explanation for the evolution of his personality, nor is such supposition biologically sound. Darwin

himself showed great insight into this matter. The wife of his old friend Lyell asked him how her children could be given a taste for natural history. He replied that the one way to destroy such a taste would be to give them specimens; the youngsters, he said, must themselves be collectors to acquire a taste, and added that if he had a collection of English butterflies he would be systematically most miserly and not give his boys half a dozen specimens a year.

In other words, every normal youngster is a natural-born explorer—with eyes, ears, nose, tongue, fingers; given a fair chance, he will explore the known universe. The amount of the universe which he actually explores is, in the vast run of human beings, infinitesimally small; parents and society begin to tell the youngster almost from birth to let the universe alone, or at best refer him to some textbook, and thereby end his curiosity.

We know much of Darwin's father, not so much of his mother, but from what we know in general of that household we cannot conceive that, when he brought his first beetle home, he was reprimanded and told to throw it out of doors. On the positive side, we can be certain that by the age of eight he had received no checks to his innate exploratory tendencies from his father, and a certain amount of approval from his mother. It is not without significance that, in the first portrait made of him, he is kneeling in front of his little sister Catherine, who holds a flower in her hand, while he holds a potted plant. Incidentally, they make a handsome little

couple, and in their wide-open eyes can be discovered no trace of fear.

Nor can there be any doubt that at the time he was inventing deliberate falsehoods to cause excitement, he himself had already been excited by the eternal riddle of the origin of living beings. The part the mother played in stimulating this passion we can only guess at, but in quoting his mother he revealed the fact that the great secret which interested her was also the genesis of living beings. To read that secret would be to carry out one of his mother's dearest wishes. It was that wish of hers above all others that stuck to him through life and became the main impulse which was to lead to the *Origin of Species*, the *Descent of Man*, and *Selection in Relation to Sex*, the *Effects of Cross and Self-Fertilization in the Vegetable Kingdom*, and to a score and more papers which set forth his searchings into the secrets of fertilization in plants and animals. In fact, his whole life was spent in answering the riddle which sooner or later comes to every boy, but which too often is stepped on by an ignorant father or shamed to silence by a prudish mother—the riddle of the origin of life and the genesis of himself.

That Darwin, fifty-nine years later, could characterize the yarn he told his playmate about how he could color flowers by watering them (or, according to the other version, learn their names by looking inside the blossom) as a "monstrous fable," gives us a picture of the then prevailing attitude toward children who were curious about the processes of

fertilization. Unfortunately, such curiosity on the part of children is still too often regarded by grown-ups as a sign of immorality.

Had this mother been less frank as to the things which interested her, or less sincere in her curiosity, quite conceivably Charles Darwin would never have been known except as a second-rate doctor or preacher.

But where did the mother get her interests? How were they aroused? What business had this young mother of a family, more than a hundred years ago, to be frankly curious about anything?

Her name was Susannah, and she was the favorite daughter of Josiah Wedgwood, son of the founder of the famous potteries. She was educated partly in London under the eye of her father's partner, the learned Thomas Bentley, and at home with her brothers under competent tutors. She had read widely and traveled extensively. But especially had she become the favorite of her father's great friend, the celebrated naturalist, Dr. Erasmus Darwin. All of which prejudiced her favorably toward her father-in-law. Erasmus Darwin was also a poet and a philosopher; he was fond of field sports and loved exercise; and was the author of two books: one called *Zoonomia, or the Laws of Organic Life*, which has become a milestone in the history of evolution; the other called the *Loves of the Plants*.

We shall hear more of Grandfather Erasmus; it is enough here to note that Darwin's mother was fascinated by her father-in-law's scientific curiosity, and

that his theory of evolution became one of the great interests in her life. She was fond of flowers, and especially of her pigeons, whose tameness and beauty are matters of record. And note right here that, before Darwin's *Origin of Species* is ten pages old, he is talking about the origin of domestic pigeons, and that the chapter itself, the first in the book, is called "Variation under Domestication."

In 1796, when she was thirty-two years of age, Susannah Wedgwood married Robert Waring, youngest of the three sons of Erasmus Darwin. A miniature shows her with a remarkably sweet and happy face, and a countenance expressive of a gentle and sympathetic nature. Four years after the marriage, and after their first child, a daughter, had been born, they moved to The Mount, a large red-brick house which they built in 1800 on a steep bank overlooking the River Severn, in that part of Shrewsbury, the county seat of Shropshire, known as Frankwell. The Mount, which still stands, was an attractive-looking house and had a greenhouse opening out of the living room. The bank was terraced and traversed by a long walk still known as the Doctor's Walk. Among the trees bordering the walk was a big Spanish chestnut with curiously bending branches, in which young Charles and his sister Catherine had their special seats.

Charles, fifth of the six children of Robert and Susannah, was born in The Mount on February 12, 1809, which on the whole was not a bad year for geniuses: Gladstone; Mark Lemon, one of the founders of *Punch*; Braille, inventor of the type for the

blind; Elizabeth Barrett Browning; Tennyson; Fitzgerald, translator, if not author, of *Omar Khayyám*; Mendelssohn; Edgar Allan Poe; Oliver Wendell Holmes; and also, born on the same day as Darwin, Abraham Lincoln—which fact led Professor Lull to see Darwin as the emancipator of human minds from the shackles of slavery to tradition, as Lincoln was the emancipator of human bodies from a no more real physical bondage.

Of Darwin's early years we know almost nothing, and that little we learn from his autobiographical sketch written in 1876 and an autobiographical fragment written in 1838. It is only natural that his earliest recollection of himself was a scene which had been emotionally tied in. As he sat on his sister Caroline's knee while she cut an orange for him, a cow ran by the window and made him jump; he was badly cut, and carried the scar to his grave. He recalled, shortly after that incident, being taken to the seashore, where he was impressed by the white foam of the water and the horror he felt when told how people were sometimes pushed into the canal by the tow rope. He recalled one or two walks with his mother, but of the family itself, nothing. He could recall the maidservants—and especially how a shopkeeper had bribed him with two figs so that he might kiss one of them; and that either himself or Caroline was shut up in a room for trying to break windows.

Darwin's mother died in July, 1817, when he was a little over eight years old. He was at that time in many ways a "naughty boy." His only vivid recol-

lections of her were of her curious work table, her black velvet gown, and her deathbed.

He had already acquired a taste for natural history, especially for collecting. Collecting, in fact, was a "passion"—"all sorts of things, shells, seals, franks, coins, minerals." His father's brother, Erasmus, had been a famous collector of coins, statistics, and genealogies, but this uncle died a year before Charles was born. Such junk as young Darwin collected is not important in itself—it merely illustrates the fact that collections of certain kinds of objects had social value in the Darwin household.

Early in young Darwin's career as a collector, a boy friend gave him a mineral. That one mineral gave a new bent to his taste in collecting. Before he was ten he wanted to know something about every pebble in front of the hall door. He also collected birds' eggs, but the humaneness instilled into him by his sisters prevented him from taking more than one egg out of each nest. He was fond of gardening, and had a smattering of botany. He was afraid of street dogs, and had little heart for a fight. But he had strong friendship for some of his playmates.

And he loved to tell lies to excite attention and surprise. Writing about himself in 1838, Darwin thought that he was "a born naturalist." He was no more a born naturalist than he was a born liar. He grew up in a household where natural curiosity about nature had social value. A first-class natural history yarn got attention. If he could not get attention any other way he would fake a nature story, and return

from a walk declaring he had seen some strange bird! And in school he once invented a whole fabric to show how fond he was of speaking the truth!

We begin to know now, as Darwin himself could not have known when he wrote his *Descent of Man*, something of the significance of being born human. There are a billion years behind that inheritance, and millions of years behind the evolution of a family group not unlike that into which Darwin was born—father and mother, brothers and sisters, uncles and aunts, cousins and grandparents. Into such a social group Charles Darwin was born. He had no specific capacities, talents, or instincts; he did have a clean-sheet brain on which nothing was written, a brain so vast that it could serve as central for the reception of countless stimuli and for initiating countless ways of response.

Darwin at birth differed in his biologic inheritance in no fundamental respect from you or me. His uniqueness, like that of every normal human being, was to spring from the endless stream of impressions which began to beat upon him from the day he was born. Presumably a superficial glance at him would have revealed little in his personality to distinguish him from his playmates when he entered school after his mother's death; but the evolution of his personality was well on its way. He had already acquired certain specific likes and dislikes; certain specific things, people, faces, situations, occupations, made specific appeals to him. His innate curiosity had become specific in certain lines.

But while the youngster's ways were specific in this and that direction, little had yet come into his life to narrow his vision; of the prison walls which begin to close in upon the growing child, of which Wordsworth speaks, we find little trace. His personality had begun to evolve in a social group which was frankly and fearlessly curious. The net result was an open eye for nature, a keen interest in nature, and a conviction that by solving the riddle of nature he could carry on the family tradition and be worthy of his mother's love.

His mother was peculiarly fitted to direct his bents in special directions. To put it another way, she was culturally fitted to play her natural rôle, and she played it to the exclusion of the many other rôles open to women but fatal to motherhood—she *mothered* Charles. As the twig was bent, the tree inclined. And through her the grandfather became a force to condition his responses to the world at large. But what of his father? And what of the schools which were now to do their best to close his eyes to nature and shut him off from all that he loved best?

CHAPTER II

HIS FATHER WANTED HIM TO BE A DOCTOR—OR A PREACHER

My father said to me, "You care for nothing but shooting, dogs, and rat catching, and you will be a disgrace to yourself and all your family."

DARWIN'S AUTOBIOGRAPHY.

FIFTY years later Darwin could recall that remark of his father's and the feeling of deep mortification it aroused in him, but his father "must have been angry and somewhat unjust when he used such words"—for he "was the kindest man I ever knew and whose memory I love with all my heart."

Many a boy of sixteen has suffered more than deep mortification at such a paternal slap and has been definitely slowed down for life. The Shrewsbury schools, as schools, had done little to speed him on his way; Edinburgh and Cambridge were to do little more. But, as we shall see, when Darwin at last got his chance he made up for lost time, and because he could in his own way refute his father's prediction there was no hangover to his feeling of mortification, but rather numerous expressions of his gratitude, interspersed with expressions of tribute to his father's extraordinary character.

And, in truth, Darwin's father, no less than his mother, was an extraordinary character, and we

need not wonder that Darwin never forgot the debt of gratitude he owed to his ability and generosity.

Robert Waring Darwin was taken to Shrewsbury by his father, Erasmus, when he was twenty years old, and left with twenty pounds and an M.D. degree from the University of Leyden; and, except for another twenty pounds which he received from an uncle, that degree and that twenty pounds were his start in life. Yet within six months he had between forty and fifty patients, within two years a considerable practice, and thereafter a large practice and a huge income. He died a rich man, and none of his children ever had to work for a living. But the fact that this father started out with almost nothing and amassed a fortune out of the practice of medicine probably accounts for his rebuking his son Charles for carelessness in money matters, and that in turn probably accounts for Darwin's unusually generous attitude toward his own children. His son Francis records that his father paid his debt at college as though it were a virtue.

Darwin inherited the tall stature of his father, who was six feet two inches, but his long skinny legs and stooped shoulders in later life suggested little of the broad-shouldered corpulence of his father, who when last weighed tipped the beam at 335 pounds and "afterwards increased."

Curiously enough, Robert Waring Darwin at first hated the profession which he practised for sixty years, and would not have followed it "for anything" if he could have been sure of a living otherwise; he

had a horror of seeing people bled, and the thought of an operation almost made him sick, yet so successful was he that out of his fees he was keeping two horses and a servant before the end of his first year's practice. His powers of observation and of sympathy were characterized by his son as unequaled. He was keen to give pleasure to others. He hated extravagance, but performed generous acts. He lent ten thousand pounds to a small manufacturer without legal security, and twenty pounds to a strange Irishman. His huge success seemed to be due to his unbounded power to win confidence.

Quite unlike Darwin's grandfather, his father was given to detail rather than to generalizing. His hobbies were his garden, his ornamental trees and shrubs and fine fruit trees. He seems above all to have had what the psychopathologists call "insight"; in fact, we can easily believe that not only did he have a large practice because of this insight but that among his patients were many who had no organic ailment. In short, he was a first-class psychoanalyst. As a father confessor, he received many strange confessions of misery and guilt. Darwin speaks of his father remarking how many miserable wives he had known and telling of husbands and wives getting along for twenty or thirty years and then hating each other bitterly.

Dr. Darwin's almost "supernatural" power to read character and "even thoughts" was strikingly illustrated in the case of a strange clergyman who turned up in the community. He seemed rich and

was invited everywhere. But the Doctor, returning from a call on him, declared he was not to be trusted. The clergyman turned out to be a habitual swindler! Also in the case of a young insane man who was brought by an uncle to the Doctor for treatment and who accused himself of all the crimes under heaven. The Doctor diagnosed his case and declared that he really was guilty of a certain heinous crime—to the astonishment of the uncle that he could detect it. Ladies used to cry when they told their troubles to the Doctor. That used up his time. The more he begged them to refrain, the more they wept. So he encouraged them to cry! Thus they soon ceased and could tell the story of their troubles.

As illustrating both his father's generosity and his insight, Darwin relates that as few poor people availed themselves of his offer to dispense medicines gratis to those not able to pay, because they disliked to receive charity, "he told them that he would supply the medicine but that they must pay for the bottles."

The Doctor had such an extraordinary memory for dates that he could not forget one, and was so sensitive that every road out of Shrewsbury was associated with some painful event. He was easily enraged, but of unbounded kindness, and widely and deeply loved. He was a great talker, a great story-teller, a man of high spirits, laughed and joked with everyone, "even with servants, but could make them obey him to the letter; many were afraid of him"—including, probably, his son Charles.

And that was the man who was to contribute the paternal share to the evolution of Charles Darwin, whose opinions were to be remembered throughout life and his maxims quoted in every illness, and who was to be revered as fathers can only be revered by sons who have implicit belief in their opinion. When Darwin visited the old Shrewsbury home at the age of sixty, he expressed regret that he could not have been left alone in the greenhouse for five minutes—"I know I should have been able to see my father in his wheel chair as vividly as if he had been there before me." Probably his youthful memories of the dominating character of his father were too painful; the memory he loved best was of him as an old man.

Young Darwin carried to his first school a huge passion for collecting. It was a day school kept by the minister of the Unitarian chapel, to which Darwin went with his mother and sisters, although he had been christened in the Church of England and after early boyhood attended that church. As his passion for collecting got no results in that school, he entered on his brief career as a nature faker; it was there that he invented a lie to prove his love of speaking the truth. He delighted in fishing for newts in the quarry pool, and made many journeys with his father in his yellow chaise, telling him of his lessons and delighting in the sight of game and other wild birds.

In the summer of the following year, 1818, he became a boarder in Dr. Butler's school in Shrewsbury, and remained for seven years. As the school was only

a mile away and Darwin was a fleet runner, he often visited his home, keeping up home affections and interests. When he thought he could not make the journey in time, he prayed to God to help him; and attributed his success to his prayer and not to his fleetness of foot.

Dr. Butler's was one of the great schools of England at the time, with a strictly classical course and a little ancient geography and history. From this school Darwin got nothing except many friends and some pleasure from the Odes of Horace. He used to learn his forty or fifty lines of Virgil or Homer during chapel—and promptly forgot them. But over the historical plays of Shakespeare, Thomson's *Seasons*, and Byron and Scott, he would sit for hours. His mineral collection continued to grow, but he was always after a mineral with a new name. He took long solitary walks, and once was so absorbed in his thoughts that he walked off the parapet of an old fortification.

His love for dogs was so great that they readily adopted him, transferring their love to him from their masters. After killing his first snipe he became so excited he could hardly reload his gun, but he became passionately fond of shooting and admits that he was a very good shot. He kept in practice during his university years by firing with a cap at a lighted candle held by a friend, or by throwing his gun up to his shoulder before a looking-glass.

He not only read the *Wonders of the World* but discussed it with his playmates, and argued against the

probability of some of its alleged facts. This book, with Humboldt's *Personal Narrative* some years later, was to determine him to see the world with his own eyes.

In short, Dr. Butler's literary mill for the grinding out of boys fit to enter universities was not to Darwin's taste. He was happy only when he could run home to The Mount on the hill, where he could read White's *Selborne*, arrange his "collections," or work till late in the night with his brother Erasmus in the laboratory they had surreptitiously made in the garden tool house. That was the best part of his education; it showed him "the meaning of experimental science." When his schoolmates found out that he was a self-taught practical chemist, they nicknamed him "Gas." But obeying his own impulses got him nowhere with Dr. Butler, nor, indeed, with his father; on the contrary, his father thought he would be a disgrace to the family, and Dr. Butler publicly charged him with being a *poco curante* (careless person) for wasting so much time on useless subjects—which seemed to Darwin's uncomprehending ears "a fearful reproach."

Sixteen years old: a rat catcher; a *poco curante*. Time to make a change. At least so his father thought, and sent him to Edinburgh University, where his brother Erasmus was then a second-year student of medicine, and where his Uncle Charles had studied medicine for three years, to die at the age of twenty-one from an infection received while dissecting the brain of a child. That uncle, by the way, was

awarded the first Gold Medal of the Æsculapian Society for experiments on pus and mucus.

This idea of becoming a doctor did not come out of a blue sky. Charles, in a way, had already become apprenticed. He assisted his father in his practice among the poor about Shrewsbury, and once had a dozen patients. He wrote out their symptoms and read them to his father. The father would suggest further inquiries and advise medicines, which Charles would make up. His father had predicted that Charles would make a successful physician, because he had his father's knack of inspiring confidence.

But as a source of gratification for his love of natural history, the University was as flat a failure as the schools. Furthermore, young Darwin had now become convinced that he would inherit a large property, "though I never imagined I should be so rich a man as I am." That belief put a damper on any desire he might have had to learn medicine just to please his father. But some of his utter failure as a medical student must be set down to the fault of the professors.

He wrote his sister Caroline that he so disliked the lectures on human anatomy that he could not speak about them with decency—they were as dull as the lecturer himself, and the subject disgusted him! The lecturer on *materia medica* "was so very learned that his wisdom has left no room for his sense." "I shall ever hate the name of *materia medica*, since hearing Duncan's lectures at eight o'clock on a winter's morning—a whole, cold, breakfastless hour—on

the properties of rhubarb!" Even the lectures on geology and zoology he found so incredibly dull that he decided never to read a book on them or study them. And he rushed out of the operating amphitheater before an operation on a child was completed; it was long before "the blessed days of chloroform," and the case haunted him for years.

But Edinburgh to a young man like Darwin could not be a total loss. He found the Scotsmen so civil and attentive that it was enough to make an Englishman ashamed of himself—a comment provoked by a Scotch Doctor of Divinity's having shown him and his brother Ras the way to a certain house: "I should think Dr. Butler, or any other fat English divine, would take two utter strangers into his library and show them the way!" He went to church and heard a sermon of only twenty minutes; from what he had read in Sir Walter Scott, he had expected a "soul-cutting discourse of two hours and a half."

While the University did nothing for him, he met several young men who were fond of natural science and with whom he could polish up his early love. His experience with one of these, a Dr. Grant, formed such an important milestone in his career that the incident must be told in his own words: "He one day, when we were walking together, burst forth in high admiration of Lamarck and his views on evolution. I listened in silent astonishment, and as far as I can judge, without any effect on my mind." Nevertheless, that incident affected Darwin profoundly.

He had read, and greatly admired, his grandfather's *Zoonomia*. Lamarck's views, as we shall see, were so much like his grandfather's that Lamarck entered his life as a rival.

Darwin at this time was seventeen. Grant's admiration for Lamarck's evolutionary views set the stamp of approval upon his own sacred wish to learn the secrets of nature and probably favored his upholding them under a different form in his *Origin of Species*.

With Grant he attended meetings of the Natural History Society, and once heard the great Audubon talk about North American birds. At a Royal Society meeting he gazed at Sir Walter Scott, in the chair, with awe and reverence. If he had then been told that he would one day be honored by membership in the Royal Society, he would have thought it as ridiculous and improbable as if he had been told he would be elected King of England. He also attended the Royal Medical Society meetings, but did not care much about the subjects because they talked too much "rubbish." At the Plinian Society he made congenial acquaintances and had his zeal for natural history stimulated.

He and Grant often collected marine animals. He became friendly with the fishermen and sometimes accompanied them when they trawled for oysters. He became acquainted with the Curator of the Museum, who gave him some rare shells. From a Negro who had traveled with the ornithologist Waterton he

learned to stuff birds; Darwin paid him, of course, for his lessons, and "used often to sit with him, for he was a very pleasant and intelligent man."

If Darwin, the medical student, had not so and so, and if the lectures had not been so and so, and if Darwin had not learned that he would be rich, the chances are ten to one that he would have followed in the path worn smooth by his father, brother, and uncle. And his insight into human nature might even have surpassed his father's, and he might have been the outstanding physician of the Victorian Era—and it would all have been set down to heredity: he inherited an instinct for medicine! But, as Kempf puts it, for Darwin to study medicine was like marrying the wrong sister: medicine was not the girl he had learned to love at his mother's knee. To put it another way, his father could drive him to the trough, but he could not make him drink.

The fact had leaked out at home that Charles was not destined for the practice of medicine. So the father proposed "that I should become a clergyman": he would change the trough. But Darwin still refused to drink—or rather, he did drink, but to become a clergyman was even worse than marrying the wrong sister, it was to remain as barren as a vestal virgin. And Darwin's mother had not brought him up for that! It would have been easier for him to disgrace the family than to become a clergyman. But fathers are fathers, and young Charles, at the age of eighteen, was entered as a student at Christ's College, Cambridge, and began his residence in 1828. He had

been a medical student; he had now become a divinity student.

Three years "sadly wasted, and worse than wasted." Yet what a great divine was lost to the world if there is anything in phrenology! Years afterward, when Darwin had become famous in certain quarters and infamous in others, and renowned throughout the literate world, a German "psychologist" discovered that Darwin's bump of reverence was large enough for ten priests!

Darwin admitted that he ought to be ashamed of his drinking, singing, card-playing Cambridge days, but he wasn't—and looked back on them "with much pleasure." The repertoire of behavior he carried to Cambridge included a passion for shooting, hunting, and riding across country; that passion got him into a sporting set, "including some dissipated, low-minded young men, and we sometimes drank too much." While at Cambridge he also became a member of a club called the Gourmet, so named probably in derision of another club which called itself by a long Greek name signifying "fond of dainties." The Gourmets dined once a week on mutton chops or beans and bacon, generally at a roadside inn outside Cambridge. They also experimented with birds and beasts as yet unknown to their palate, but their zeal for new food fled when they tackled an old brown "indescribable" owl. After dinner there was a mild game of *vingt-et-un*. Most of the members later became canons or archdeacons.

Not a very good start for Holy Orders; but, "upon

the whole," these worse-than-wasted three years at Cambridge "were the most joyful of my happy life." And Darwin sent three of his five sons to his old Alma Mater, for though he "despised it heartily as a place of education," he loved it for its "many most pleasant recollections." Could Darwin have said that in later life if his career had not opened up so gloriously because of what he had got out of his Cambridge days? Probably not. Wherein, then, lay the failure? Why did he speak of his time as worse than wasted? Because the university bill of fare had no dish he liked—and he was a very hungry young man!

He did not like mathematics and did nothing in classics except attend a few compulsory lectures. He had already read Pearson on the Creed, and as he did not then doubt the strict and literal truth of every word in the Bible, he was prepared to take the premises of Paley's *Evidences of Christianity* on trust. And he was "impressed by its logic." By doing well in Paley and Euclid, and not failing miserably in his classics, he not only passed his examinations for the B. A. degree but got tenth place among the non-honor men. And that, in 1831, was a "university education"—and a necessary preliminary to becoming a clergyman!

Young Darwin was now qualified to take Holy Orders, and so far as can be learned was ready to lay down his life's desire to gratify his father's wish that in one way or another he become an ornament to the family.

Darwin passed his B.A. examination in April, 1831, but he had to keep two more terms to fulfil the time requirement: he could not receive his degree until June of the following year. Much happened during these two enforced terms, so much that the Church of England was to be deprived of the services of a man with a bump of reverence enough for ten priests, and Darwin was to live to see—considering how fiercely he was attacked by the orthodox—the ludicrousness of the fact that he had once intended to be a clergyman!

But all that happened between April, 1831, and June, 1832, was largely because Darwin's undergraduate days had been far from wasted as he seemed to think—he had become known as "the man who walks with Henslow."

Even before he went to Cambridge Darwin had heard of Henslow as the man who knew every branch of science, and he was "prepared to reverence him"—by which he meant love, not fear. Henslow was a clergyman of the Church of England, was deeply religious, and so orthodox in his faith that he once told Darwin he should be grieved if a single word of the Thirty-Nine Articles were altered. Henslow was also botanist, entomologist, chemist, mineralogist, geologist: to walk with him was for Darwin to walk with omniscience!

There were two Charles Darwins at Cambridge: one rode into the sporting set; the other walked with Henslow—and that was the real Darwin. Henslow, the devout, supplied the stimulus to which Darwin

could respond as his father would wish; Henslow, the scientist, the stimulus to which he could respond as his mother would have wished. And Humboldt was to fan the little ember set aglow by the *Wonders of the World* into a blazing torch which Darwin was to carry around the world to shed light from the tops of the mountains to the depths of the seas.

We must look more closely at this real Darwin: what manner of man was this failure in medicine who could inspire a fellow student in Edinburgh to predict that he would become famous and write in his book, "Charles Darwin, Esq., M.D., F.R.S."—even though he added "A.S.S."? What manner of man was this young sportsman who could inspire a sporting friend also to predict that he would one day be a Fellow of the Royal Society, and so impress a devout Cambridge professor that he set him on the road which led to fellowship with the geniuses of the human race and the benefactors of mankind?

CHAPTER III

HE HIMSELF PREFERRED TO WALK WITH HENSLOW

I consider that all I have learnt of any value has been self-taught.

DARWIN'S REPLY TO GALTON'S QUESTIONNAIRE, 1873.

IF YOU can find any man of common sense who advises you to go I will give my consent." It was Darwin's father who said that, and again he was wrong—the third time he had done his best to deal his son a hand that Charles could not play, his third bungling effort to sentence a potential genius to jail for life. That father may have been as good a guesser as the son thought he was, but he certainly mis-guessed his son three times, and himself we know not how many; and never more so than when he gave his consent for Charles to sail on the *Beagle* on the guess that no man of common sense would advise the trip. Uncle Jos did so advise—and Dr. Darwin had to admit that his wife's brother Josiah Wedgwood not only had common sense but was one of the most sensible men in the world. And Charles sailed.

But how came that opportunity that knocks but once in a lifetime to knock at his door? What else had he done between his entrance into one of the best classical schools in England and his departure from one of the best classical universities in the world, besides fail to be "educated"? Why was it that the

great Professor Henslow should recommend him for a position he himself would gladly have accepted if his wife had not looked so miserable when he broached the subject? In short, what had Darwin got out of his "education," and what had he done outside the schoolroom, to fit him to wrestle with nature for five years, to begin to trip her up before the match was really begun, and in the end to prove that she was no more than natural?

Galton in 1873 addressed a questionnaire to English scientists. Under the general question of education was: "How taught?" Darwin replied: "I consider that all I have learnt of any value has been self-taught." Was his education conducive to or restrictive of habits of observation? "Restrictive." Did it have any peculiar merits? "None whatever." In other words, in the evolution of Charles Darwin, Charles himself was always present and had his say. Circumstances, in the form of his father, said: "Follow the family tradition and practise medicine"—and Charles just couldn't; "Very well, then, preach"—one wonders what kind of a clergyman Darwin would have become if . . .

Well, if for one thing he had not been so eternally curious about so many things. Let us see. When ten years of age he made a trip to Wales, and discovered that the local insects, moths, etc., differed from those in Shropshire. How many boys of ten to-day know an insect from a moth, or feel, as young Darwin did, that it is not right to kill insects? But then we must remember that he had already read

White's *Natural History of Selborne*. He collected all the dead insects he could find, watched the habits of birds and made notes, and wondered why every gentleman did not become an ornithologist!

He had been shown, when a schoolboy, a boulder called a "bell-stone," and was told that the world would come to an end before anybody could explain how it got there. That aroused his curiosity and made a deep impression on him—and he "meditated over this wonderful stone." The seed of curiosity then planted was ready to flower when Agassiz came along and showed how Europe had been overrun by glaciers carrying great rocks across the country. That bell-stone had been brought into Shropshire by a glacier.

One summer vacation was spent in a walking tour in Wales; he covered thirty miles a day; ascended Snowdon; and took long horseback trips with his sister. And he was so crazy about shooting that he was a bit ashamed of it later in life and seemed to think he had to excuse himself for his zeal by calling it an "intellectual employment": skill was required in locating the game and in knowing how to hunt the dogs well! He made a list of every bird he shot and kept track of the birds he shot each day by making a knot in a string tied to his buttonhole. When he went to bed at night he would leave his shooting boots open by his bedside, so that he could jump into them without losing a moment.

Shortly before the opening of the hunting season he wrote a friend: "Upon my soul, it is only about a

fortnight to the 'First,' then if there is a bliss on earth, that is it." And yet that same lad, in that same year, could be so painfully impressed by finding a bird that had been shot the previous day not quite dead, that he made up his mind not to shoot any more.

Next to his passion for shooting came his craze for collecting. Imagine a modern undergraduate while studying for his examinations writing a friend that he had not "stuck a beetle" that term! Or to another friend wishing that they were spending the Christmas vacation in Cambridge: "How we would talk and walk and entomologize! Sappho should be the best of bitches and Dash of dogs: then should be 'Peace on earth, good-will to men'—which, by the way, I always think the most perfect description of happiness that words can give."

So rabid was his quest for beetles that he employed a laborer in winter to scrape moss from old trees and to collect rubbish from the bottom of the barges in which reeds were brought up from the fens. Out of the moss and rubbish he got many rare species. And "no poet ever had more delight in seeing his first poem published than I did at seeing, in Stephens' *Illustrations of British Insects*, the magic words, 'Captured by C. Darwin, Esq.'"

Once he was tearing off the bark of a tree, searching for beetles, and saw two rare specimens; he seized one in each hand. Then he saw a third, a new kind, which he did not want to lose, so he popped the one he held in his right hand into his mouth. It ejected

an intensely acrid fluid, "alas!", which burned his tongue, so that he was forced to spit the beetle out, and lost it and the third one as well! But he generally got his "beetle" and by the time he left Cambridge he had a remarkably fine collection of insects. He was an original member of the Entomological Society of London, founded in 1833.

Many delightful visits to the Wedgwood household at Maer must not be overlooked. He seemed to have little interest in the potteries, but was greatly attached to and revered his Uncle Jos, who was a very upright man with clear judgment. Young Darwin seems to have been greatly influenced by this uncle.

We begin to see now why he spoke of his Cambridge days as the most joyous of his life. To riding, shooting in the fens, suppers, card-playing, he added what to him were equally good sports—collecting beetles and botanizing. He even infected his friends with the joy of collecting beetles or with a taste for botany. One of his Cambridge chums later spoke of him as preëminently good, just, and lovable; the most genial, warm-hearted, generous, and affectionate of friends; sympathetic with all that was good and true; hating everything that was false, vile, cruel, mean, and dishonorable.

And he could be inoculated with new tastes as well as infect his friends with his own. One friend introduced him to good pictures and engravings, and they paid frequent visits to the Fitzwilliam Gallery. Another friend introduced him to a musical set, and in spite of his want of a musical ear he soon acquired

a strong taste for music. He learned to take great delight in a symphony or overture of Mozart or Beethoven, with their full harmonies. One afternoon they heard a very beautiful anthem in King's College Chapel; at the end of an exceedingly impressive part Darwin turned to his friend and said, with a deep sigh: "How is your backbone?"—referring to a coldness or shivering he felt in his back when he heard beautiful music.

He used to go alone to King's College Chapel, and even hired chorister boys to come to his "most snug and comfortable rooms," as he called the pleasant paneled set of rooms in which he lived on the south side of the first court of Christ's College. On a wall of those rooms to-day, by the way, a bronze tablet commemorates Darwin's undergraduate days, as does a similar tablet the rooms occupied by Newton in the same college. Those rooms have become shrines.

And wherever he went Darwin had some book with him—of travel, of adventure, of exploration, of natural history. Two of the books he had read had already become determining factors in the evolution of his personality: the *Zoonomia* of his grandfather; the *Wonders of the World*. In his last year at Cambridge he met two more books which were to rouse him: Herschel's *Natural Philosophy*; Humboldt's *Personal Narrative*. Herschel interested him profoundly; Humboldt stirred him to the very depths—nothing had ever so stimulated his zeal, and his mature judgment was that Humboldt was the greatest scientific traveler that ever lived.

He was especially excited over Humboldt's description of Teneriffe, copied long passages about it, decided he would see it, and even got an introduction to a London merchant of whom he might make inquiry about sailings. So stirred was he that he wrote his cousin Fox that he had "read and re-read" Humboldt, and that he was talking, thinking, and dreaming of a scheme almost hatched for going to the Grand Canaries. He even set the date of departure for June of the year after he was to receive his degree, and began to study Spanish.

Cambridge without Humboldt might have led Darwin into the ministry; without Henslow one would be rash indeed to predict the fate of Darwin at the age of thirty, or in fact at any moment of his life after he came down from the university. Darwin himself claimed that Henslow had influenced his whole career more than any other man, and that his chief interests in natural history before he knew Henslow were foxes and partridges; after he knew him his natural history interests were as wide as Nature herself.

As I have said, young Darwin had heard of Henslow before entering Cambridge, and was prepared to reverence him. Shortly after he had met him he spoke of him as his "tutor" and as "quite the most perfect man" he ever met; and a little later, in a letter to Fox, said that he didn't know whether he loved or respected Henslow more. His letters to Henslow during his long voyage on the *Beagle* overflow with affection, veneration, and obligation to his "accom-

plished master and dearest friend." He has been well called the worthy teacher of a worthy pupil.

Henslow had just exchanged his professorship of mineralogy for that of botany, and it was as a botanist that Darwin first met him. His lectures were "universally popular and clear as daylight." His character especially profoundly impressed the young man. To a deep sense of religion he added an even temper, and a view of his fellow men which was free from ill-nature, vanity, envy, and jealousy; and "when principle came into play, no power on earth could have turned him one hair's breadth." All interested in any phase of natural history were equally encouraged by him, nor could anything be more simple, cordial, and unpretending than that encouragement. In such manner did Darwin many years later pay tribute to the character of his old teacher; he was unconsciously describing his own.

To the open house Henslow kept once a week, Darwin soon received an invitation and thereafter went regularly. He often joined the family at dinner, took many walks with Henslow, and went with him on long delightful trips. He came to revel in these excursions, on foot or in coach, or down the river in a barge, "or to some distant place to see the wild lily of the valley and to catch on the heath the rare natterjack."

Not only Henslow, but other older men whom he met at Henslow's, allowed Darwin to associate with them; and he, looking back through forty years, "inferred" that there must have been something in

him a little superior to the common run of youths, or they would not have given him their friendship. There must have been, indeed! But do not overlook the fact that Darwin's intimacy with Henslow was largely due to the fortuitous circumstance that he was obliged to reside two terms in the university after he had passed his final examination.

It seems that on a botanizing excursion in the spring of 1831 Darwin read to Henslow some extracts he had copied from Humboldt about Teneriffe. This prompted Henslow to bring Darwin in contact with Sedgwick, the professor of geology. Up to this time Darwin had not met Sedgwick, nor had he attended any of his lectures, for, as he tells us, he had become so soured on lectures while at Edinburgh that, apart from Henslow's, he attended no public lectures at Cambridge.

It required little persuasion by Henslow to induce Darwin to begin the study of geology. By July we find him "working like a tiger" to make a geologic map of Shropshire. A letter to Henslow at the time shows how his mind was working: he had already begun to "indulge in hypotheses"—but they are such "powerful" ones Darwin supposes "if they were put into action for but one day, the world would come to an end." Shortly after that, and at Henslow's suggestion, he accompanied Sedgwick on a geologizing trip into Wales.

The First of September was at hand—and Darwin left for home to get ready for the shooting, "for at that time I should have thought myself mad to give

up the first days of partridge shooting for geology or any other science." Geology had to stop.

But the man who had come to be called "the man who walked with Henslow" had not spent three years at Cambridge in vain. The university itself had furnished him little of profit, but in his recreations, in his holidays, in the fens and waste places about Cambridge, in his contacts outside the classroom with men whose opinions he could respect and whose tastes fitted in with his own early bents and wishes, he had acquired the method of science; in walking with Henslow he had learned to walk without a guide. Those Cambridge years were so far from wasted that he was now fit to play the hand that Fate was about to deal him.

Darwin shot no partridges that autumn: Fate had dealt him a new hand. A long letter from Henslow awaited him at home saying that Fitz-Roy, captain of H.M.S. *Beagle*, was willing to share his cabin with any young volunteer who would make the cruise on the *Beagle* as naturalist. The letter ended: "Don't put on any modest doubts or fears about your disqualifications, for I assure you I think you are the very man they are in search of; so conceive yourself to be tapped on the shoulder by your bum-bailiff and affectionate friend." Would Darwin accept? Had he been using to-day's vernacular he probably would have replied: "Don't be foolish!" That *Beagle* invitation was made to his particular order—and he had to decline it! His father not only objected but allowed that "no man of common sense

would advise such a trip." Darwin that night wrote to Henslow and refused the offer.

We have Darwin's own record of his thoughts on many sleepless nights; there is nothing on record as to what he thought about that night. But as he admits that he could "swear like a trooper," we can suspect that if we did know his thoughts they would not fit the printed page. At any rate, what he thought or did that night is plain blank.

Recall again how bitterly the father had reproached his son for his schoolboy sporting ways. The son had done little since to convince his father that he might not yet disgrace himself and his family. Dr. Darwin's own brother Erasmus had been a dilettante all his life, to die by his own hand at the age of forty in a fit of insanity. For all he knew to the contrary, Charles had wasted his own time and his father's money at Edinburgh and Cambridge. Was the son, the waster at Cambridge, in rebellion against his father's wishes? He would not refuse the ministry, just as he had not refused to go on with his medical career, but from the size of his son's Cambridge debts Dr. Darwin could easily infer the kind of life he had been leading. Money was one of the father's objections to Charles taking the *Beagle* voyage. The son had urged that he would have to be "deuced clever" to spend more than his Cambridge allowance aboard the *Beagle*. The father came back with a smile: "But they tell me you *are* very clever."

The next morning he went to Maer to begin his shooting trip from the home of the Wedgwoods,

whence had come his mother and in which he was to find his wife. The next day he wrote his father. The very first sentence shows the son's attitude: "I am afraid I am going to make you again very uncomfortable." He went on to say that his excuse for writing was the way the Wedgwoods viewed the subject. But the father was not to consider that he was so bent on going that he would for one *single moment* hesitate if the father thought he would continue to be uncomfortable. He hoped his letter would not give his father much uneasiness, and did not know what to say about Uncle Jos's kindness, nor could he forget how he had interested himself in him.

And what an uncle Uncle Jos was! That same day he wrote the Doctor, and in eight reasonable and logical paragraphs answered the eight objections which Charles had set down as the principal ones his father had against the journey. Our interest is not so much in Uncle Jos's answers as in the objections themselves, for in them we get an analysis of a distinguished father's attitude toward a son he did not at all understand. The journey would be disreputable to his character as a future clergyman; it was a wild scheme; a useless undertaking; another change of profession; and on his return from the voyage he would never settle down to a steady life. These five objections were natural in a father who had had his own struggles when a boy because his father was tight in money affairs, and because he himself had never been able to profit by the theories which, as his son tells us, he formed for almost everything that oc-

curred. The other three objections, while natural enough from a father, are rather lame: accommodations on board ship would be most uncomfortable; the position must have been offered to many others before it was offered to his son; and because nobody else accepted it, there must be some serious objection to the ship or to the expedition.

Uncle Jos just could not see the Doctor's objections. Besides, Charles was not absorbed in anything, nor would it be interrupting him. Would he be any steadier or more able to settle down if he stayed at home? Weren't sailors prone to settle in domestic and quiet habits?

Uncle Jos, with Charles, followed up this letter in person, driving the thirty miles to Shrewsbury in order to talk it over.

The Doctor could not resist, and in the "kindest manner" consented.

The plot from now on moves fast. The next night young Charles slept at the Red Lion in Cambridge, and tired as he was sent a note to Henslow warning him that he would turn up in the morning.

"There is indeed a tide in the affairs of men," Darwin wrote to his friends a few days later. It was high tide now and he had to go out with it.

After long talks with Henslow about plans, equipment, etc., he rushed up to London to see Fitz-Roy, the *Beagle's* commander. This twenty-three-year-old scion of the House of Stuart seems to have been a bit of a phrenologist; he thought he could judge a man's character by his features. And he did not like

the shape of the nose of the young man who was volunteering to be his naturalist and share his cabin on a long voyage. Again we must infer what passed through Darwin's mind before Fitz-Roy decided that he would chance Darwin, nose and all.

A long letter to sister Susan on September 5th was crammed with details, excitement, and plans; and to Henslow he wrote: "*Gloria in excelsis!* is the most moderate beginning I can think of. . . . What changes I have had. Till one to-day I was building castles in the air about hunting foxes in Shropshire, now llamas in South America." He was delighted with Fitz-Roy and was sure it would be his own fault if they did not suit.

We may note here that these two young men did "suit," and the depth of Darwin's attachment to Fitz-Roy may be inferred from the close of a letter he wrote him ten years later: "Farewell, dear Fitz-Roy, I often think of your many acts of kindness to me, and not seldomest on the time, no doubt quite forgotten by you, when, before making Madeira, you came and arranged my hammock with your own hands, and which, as I afterwards heard, brought tears into my father's eyes."

A letter to Susan the next day requests "Nancy" to make him twelve shirts, and "Edward" to send his slippers, Spanish books, new microscope, geological compass, and taxidermy book, in his carpet bag. A few days later he told Susan that he had bought some pistols and a rifle for £50—"There is a saving"; Fitz-Roy's firearms had cost £400, and Darwin would

be "hanged" if he would give £60 for a case of pistols as Fitz-Roy had recommended him to do. The shops were shut, and he had been "child" enough to pay a guinea for a seat to see the Coronation procession of William IV—"like what one sees in picture books of Eastern processions." And for the first time in his life he found London very pleasant, and its hustle, bustle, and noise in unison with his feelings.

The sailing of the *Beagle* had been postponed to November 4th. On October 17th Darwin wrote to Fitz-Roy: "What a glorious day the 4th of November will be to me! My second life will then commence, and it shall be as a birthday for the rest of my life."

To his cousin Fox he wrote of his "moments of glorious enthusiasm when he thinks of the date and coco trees, the palms and ferns so lofty and beautiful, everything new, everything sublime. How grand such recollections must be! in after life." He was recalling the intense pleasure Humboldt seemed to derive from looking back upon his days in the tropics.

Again the sailing of the *Beagle* was postponed. On November 15th Darwin wrote to Henslow that she looked most beautiful. He thought her the most perfect vessel ever turned out of the dockyard; certainly no vessel had ever been fitted out so expensively and with so much care! But even after she was all ready to sail she was twice driven back to port by gales.

The long delay at Plymouth was the most miserable time he ever spent. He even looked forward to

seasickness with something like satisfaction—"anything must be better than this state of anxiety."

In Darwin's diary, under December 27, 1831, is the one entry: "Sailed from England on our circumnavigation"—and that in Darwin's opinion was the most important event in his life and determined his whole career. And yet the mere fact of his sailing on the *Beagle* was the result of more factors than there are words in this book, not the least of which were a distressed look on Mrs. Henslow's face and the great good sense of his Uncle Jos. And he nearly lost the opportunity that knocks but once in a lifetime because Captain Fitz-Roy thought the shape of his nose indicated a weak character!

Apparently this nose incident rankled. Thirty years later, in an attempt to controvert Lyell's position that certain variations were "preordained and guided by an intelligent cause," he asked: "Will you honestly tell me whether you believe that the shape of my nose (eheu!) was ordained and 'guided by an intelligent cause'?"

CHAPTER IV

THE VOYAGE OF THE BEAGLE

The voyage of the Beagle has been by far the most important event in my life, and has determined my whole career. . . . I owe to the voyage the first real training or education of my mind; I was led to attend closely to several branches of natural history, and thus my powers of observation were improved.

DARWIN'S AUTOBIOGRAPHY.

THE delight of sitting on a decaying trunk amidst the quiet gloom of the forest is unspeakable and never to be forgotten. How often have I then wished for you. When I see a banana I well recollect admiring them with you in Cambridge—little did I then think how soon I should eat their fruit.”

Thus wrote Darwin to his old friend Henslow before the *Beagle* had really got well started. He was a youngster of twenty-three and had just reached Brazil. There were no United Fruit Companies then, or refrigerator boats, and the bananas he and Henslow admired in Cambridge probably sold for two or three shillings apiece. But the delight Darwin felt amidst the quiet gloom of a tropical forest is indeed unspeakable, never to be forgotten, and certainly not to be described. As Darwin wrote to an old friend later: “A Persian writer could alone do justice to it, and if he succeeded, he would in England be called the ‘Grandfather of all liars’!”

The reading of Darwin's *Journal of the Voyage of the Beagle* early in life was a big factor in helping me decide that I should see the tropics, at all costs, sooner or later—just as we have seen that Darwin's reading of Humboldt's *Personal Narrative* had inflamed him to look at the world with his own eyes.

The *Beagle* belonged to an old class of ten-gun brigs which were so prone to go down in rough seas that they were called "coffins." When her refitting for this cruise was begun she was found to be so rotten that she had to be practically rebuilt, hence the fact that her sailing was twice postponed. But by the time she had been converted into a six-gun barque, bristling with lightning rods—even on the flying jib-boom—and lined with mahogany and "everything on a grand scale," she was a miracle of a ship to young Darwin's eyes.

In these days of round-the-world cruises in 35,000-ton ships, with more comforts than home, and larger quarters, it is not easy to realize the discomforts that must have been Darwin's on that little old 235-ton barque with sixty-six souls and Darwin's "devilment" aboard.

Darwin's "cabin" was at the end of the chart table, where he worked, dressed, and slept, and had "just room enough to turn around." In one corner were small drawers for his clothes, but only by removing the top drawer was there room enough for his hammock, which was left hanging over the table so that he might pass the time with a book of travel when the sea was so rough he could not sit at his table. It

must have been a lively little cabin: Darwin with microscope and marine animals, the navigator with his charts. After working for an hour or so Darwin would say: "Old fellow, I must take the horizontal for it," and stretch out for a little bit.

And yet in Darwin's eyes it was a "capital" cabin; nor had anyone, he wrote his father, ever gone out "better provided for collecting and observing in the different branches of natural history." The ship was "singularly comfortable for all sorts of work." The cramped space made him "so methodical." "And if it was not for seasickness the whole world would be sailors." But "nobody who has only been to sea for twenty-four hours has a right to say that seasickness is even uncomfortable. The real misery only begins when you are so exhausted that a little exertion makes a feeling of faintness come on."

Darwin in later years often referred to the discipline he had learned aboard the *Beagle*, and the lessons in tidiness because "tidiness was an absolute necessity." But the First-Lieutenant, responsible for the smart appearance of the ship, might not have agreed that Darwin was so tidy: his "damned beastly devilment," as he called Darwin's specimens, littered up his deck, and "if I were skipper, I would soon have you and all your damned mess out of the place."

Darwin messed with the Captain and hence was "Sir'd" by officers and crew. Breakfast was at eight, neither waiting for the other, each bolting as soon as through eating. Dinner was served at one and tea at five. And nothing but water ever came on the table.

What manner of man was this twenty-three-year-old landlubber who soon became known to the crew as the "Fly-catcher" and to the officers as the "Dear old philosopher"? Let us look forward fifty years. The great Darwin is dead, the world is lamenting the loss of its friend. An old *Beagle* shipmate, now an admiral, declared that in all the five years on the *Beagle* Darwin was never known to be out of temper or to say one unkind or hasty word of or to anyone. Still another old shipmate, also now an admiral, recalled young Darwin as vividly as if it were only a week ago that they had been on the *Beagle* together: no one could ever forget "his genial smile and conversation"; Darwin was the only man he ever knew against whom he had never heard a word said, "and as people, when shut up in a ship for five years, are apt to get cross with each other, that is saying a good deal"!

What an angel of a mother Darwin must have had!

We cannot follow this young man on his long voyage across seas and continents and over plains and mountains, nor can we even begin to enumerate the things he saw, but we can say that no man ever saw more in an equal space of time, and we can seek something of the spirit of the observer and note some of the things that opened his eyes wider than they had ever been opened before.

After ten days' sailing the *Beagle* reached Teneriffe, toward which Darwin's eyes had been turned for years. But he was only to see the rugged outline of the Grand Canary from the sea, for cholera raged

and no one was allowed ashore. Ten days later they called at the Cape Verde Islands, and Darwin at once began to set about the business of his trip. And before the *Beagle* had sailed for Brazil this lad of twenty-three had begun to make contributions to knowledge.

He had witnessed a dust storm a hundred miles at sea, from which no less than sixty-seven different kinds of animal life were discovered, practically all inhabitants of fresh water. He had watched the habits of the octopus or cuttlefish, and was "much amused by the various arts to escape detection used by one individual, which seemed fully aware that I was watching it. Remaining for a time motionless, it would then stealthily advance an inch or two, like a cat after a mouse; sometimes changing its colour: it then proceeded, till having gained a deeper part, it darted away, leaving a dusky train of ink to hide the hole into which it had crawled." He speaks of its power to change its color as equaling that of any chameleon, accommodating the changes to the color of the ground which it passed over. Yellowish green, dark brown, and red were the prevailing colors: "This fact appears to be new, as far as I can find out." The fact that the devilfish he kept in his cabin was "slightly phosphorescent in the dark" may have prompted the First-Lieutenant to speak of his menagerie as he did.

After attempting to describe his delight at the tropical foliage of the Cape Verde Islands, he ends a letter to his father with this significant line: "Whenever I enjoy anything I always look forward to writ-

ing it down either in my log book or in a letter; so you must excuse raptures, and those raptures badly expressed."

On crossing the Equator he had to be "initiated"—being "shaved" he called it in a letter home; a "most disagreeable operation," during which his face was rubbed with paint and tar, forming a "lather for a saw, which represents the razor." He was then half drowned in a sail filled with salt water. And referring to other matters he promised not to rapturize again, but gave himself credit for not being "crazy out of pure delight."

Brazil put him in a "perfect hurricane of delight and astonishment." The spiders gave him so much pleasure from their novelty that he was "red-hot" over them; he thought he had already taken several new genera. But it was geology that especially delighted him. It was like the pleasure of gambling, speculating on first arrival what the rocks might be. "I often mentally cry out 3 to 1 on *tertia*, primitive; but the latter have hitherto won all the bets." He had already begun to worry as to whether he was "noting the facts right."

Three months passed like so many weeks in the region around Rio de Janeiro. To behold its luxuriant vegetation was to realize the visions in the Arabian Nights; the brilliancy of the scenery threw him into a "delirium of delight." He had formerly admired Humboldt: "Now I almost adore him; he alone gives any notion of the feelings which are raised in the mind on first entering the tropics."

In short, Darwin was prepared to like the tropics; they exceeded his expectations. Otherwise they might have called out in him an entirely different reaction. The story is told that Charles Dudley Warner took two English friends to see the Grand Cañon: one burst into tears, the other into unbridled blasphemy!

Darwin's problem was to find words. He found epithet after epithet too weak to convey his sensation of delight. "The land is one great wild, untidy, luxuriant hothouse, made by Nature for herself, but taken possession of by man, who has studded it with gay houses and formal gardens. . . . The form of the orange-tree, the cocoa-nut, the palm, the mango, the tree-fern, the banana, will remain clear and separate; but the thousand beauties which unite these into one perfect scene must fade away; yet they will leave, like a tale heard in childhood, a picture full of indistinct, but most beautiful figures."

There was one fly in his Brazilian ointment: slavery. He saw more of the workings of that system than his stomach would stand. He had been told that his opinions about slavery would change after living in a slave country: the only change he could discover was a "much higher estimate of the Negro character. It is impossible to see a Negro and not feel kindly toward him. I never saw any of the diminutive Portuguese, with their murderous countenance, without almost wishing for Brazil to follow the example of Hayti." He described how an old Negro woman in a party of runaway slaves, sooner

than be captured by the soldiers to be returned to slavery, dashed herself to pieces from the summit of the mountain: "In a Roman matron this would have been called the noble love of freedom: in a poor negress it is mere brutal obstinacy."

He was crossing a ferry with an uncommonly stupid Negro. To make him better understand, he talked in a loud voice and made signs—"in doing which I passed my hand near his face. He, I suppose, thought I was in a passion and was going to strike him; for instantly, with a frightened look and half-shut eyes, he dropped his hands. I shall never forget my feelings of surprise, disgust, and shame, at seeing a great powerful man afraid even to ward off a blow directed, as he thought, at his face. This man had been trained to a degradation lower than the slavery of the most helpless animal." Some Nordic psychologists to-day would ascribe the Negro's behavior to the "Black man's instinct for submission." But Darwin was right: the Negro had been *trained*.

From early 1832 to September, 1835, the *Beagle* was off the coast of Patagonia and the west coast of South America. Darwin traveled back and forth over the Patagonian deserts, penetrated the forests of Tierra del Fuego, and climbed the Andes. The sublimity of the Patagonian deserts and the forested mountains of Tierra del Fuego left on him an indelible impression, nor could he ever forget the sight of the naked savages. There were long trips on horseback, and longer excursions along the coast in small boats.

There were discomforts and dangers aplenty, but they were "hardly a drawback."

In Patagonia Darwin unearthed gigantic fossil remains of some of the early mammals. His workmen wondered how they got there, and feeling that they had to solve the problem, concluded that they had been burrowing animals! And neither Cambridge nor any other university in 1833 had any better explanation for the existence of fossil remains.

Three years before, Captain Fitz-Roy had taken to England a little party of Tierra del Fuego natives, as hostages for a boat that had been stolen, to the great jeopardy of his surveying party. He had educated these natives at his own expense; to return them now to their native land was one of the objects of this voyage of the *Beagle*. The party consisted of "Jemmy Button" (so named because when a child he had been bought for a button), "York Minster," and "Fuegia Basket." York Minster was a full-grown, short, thick, powerful man, reserved and morose, and violently passionate when excited, but with a good intellect and very affectionate toward his friends. But Jemmy Button was the ship's favorite. He was a merry fellow and so sympathetic that he used to approach Darwin when he was seasick and say in a plaintive voice: "Poor, poor fellow!" But behind Darwin's back he would laugh at the idea of anybody being seasick.

Darwin's description of the reception these natives got from their friends, and of the life of the natives in

general of Tierra del Fuego, is among the most interesting passages in his *Journal*. The meeting between Jemmy Button and his family was "less interesting than that between a horse, turned out into a field, when he joins an old companion. There was no demonstration of affection; they simply stared for a short time at each other; and the mother immediately went to look after her canoe."

When pressed by hunger in winter, they kill and devour their old women before they do their dogs. Asked why, the answer was: "Doggies catch otters, old women no." Darwin's informant described how the old women were choked to death by being held over smoke, imitating their screams as a joke, and named the parts of their bodies which were considered delicacies.

On returning a year later to Tierra del Fuego they found, instead of the clean, well-dressed, stout Jemmy Button they had left, a thin, naked, squalid savage: York and Fuegia had stolen his clothes. But he had taught his friends a little English! Jemmy was so glad to see his old shipmates that he made them many presents, including valuable otter skins. But he turned down cold the Captain's offer to take him back to England.

To his sister Darwin wrote of a certain mountain peak as the "highest mountain in the South, excepting Mt.!! Darwin!! . . . I hope Father will forgive all my extravagance, but not as a Christian, for then I suppose he would not send me any more money." Two other geographic features were to be named after

this young explorer—Darwin Sound in Tierra del Fuego, and Port Darwin in Australia.

From the Falklands he wrote Henslow that he was “charmed with the geology, but like the wise animal between two bundles of hay, did not know which to like the best, the old crystalline rocks or the fossiliferous beds.”

He records having to cut down a large tree in order to get a monkey which he had shot and which, even though dead, continued to support the weight of its body by its prehensile tail. Another incident which thrilled him was the shooting of a condor measuring eight and a half feet from tip to tip of wings and four feet from beak to tail.

The cargo mule of Chile, carrying weights exceeding 400 pounds—yet with delicate, slim limbs, and without proportional bulk of muscles—was a “most surprising animal. That a hybrid should possess more reason, memory, obstinacy, social affection, powers of muscular endurance, and length of life, than either of its parents, seems to indicate that art has here outdone Nature.”

It was inevitable that he should meet with one or more earthquakes. Of the very severe one in Valdivia he wrote: “A bad earthquake at once destroys our oldest associations: the earth, the very emblem of solidity, has moved beneath our feet like a thin crust over a fluid;—one second of time has created in the mind a strange idea of insecurity, which hours of reflection would not have produced.”

In the rarefied atmosphere of the high mountains

he suffered a slight tightness across the head and chest. But he thought some of that feeling might be due to imagination, for to find fossil shells on the highest ridge was to forget all about the rarefied atmosphere in his delight. The natives recommended onions—which might be of real service, but he found nothing so good as fossil shells.

The Chilenos thought he was a mining prospector; they could not understand anybody pecking rock in the interests of science. Darwin lulled their suspicions by asking them how it was that they themselves were not curious concerning earthquakes and volcanoes, or why some springs were hot and others cold, or why there were mountains in Chile and not a hill in La Plata. "These bare questions satisfied and silenced the greater number; some, however (like a few in England who are a century behind-hand), thought that all such inquiries were useless and impious; and that it was quite sufficient that God had thus made the mountains."

By the middle of 1835 the *Beagle* had reached the Galapagos Islands, with their curious fauna and flora, which raised so many questions in Darwin's mind that he was to spend many years of his life in answering them.

These small, barren, rocky islands, Darwin discovered, were geologically recent—fresh, as it were, from the hands of their Creator. That meant that he here stood face to face with that great fact, that mystery of mysteries, the first appearance or the creation of new beings on this earth! So he believed

—and was thrilled. But could that “creation” theory be stretched to fit the facts as he saw them? And he kept on asking himself, Why? Why? Why? Why had the first new inhabitants of these tiny, basaltic, lava specks, with their peculiar climate, and differing in geology from the mainland, been created on American types of organization? These islands themselves were as different in character and origin from the mainland as though they were a million miles away; why should not their “inhabitants” be different? His answer to that question was to revolutionize human thought.

Then down the Pacific to Tahiti. One who has not spent much time among bronze-skinned peoples cannot appreciate Darwin’s remark that it does not require much habit to make a dark skin more pleasing and natural to a European eye than his own color: “A white man bathing by the side of a Tahitian was like a plant bleached by the gardener’s art compared with a fine dark green one growing vigorously in the open fields.” He gave credit to the missionaries for the improvement in Tahitian morality and religion, declaring that those who railed at the missionaries were not content to compare the present state of the islanders with that of the days of Captain Cook, nor even with that of Europe, but compared it with the high standard of Gospel perfection—“they expect the missionaries to effect that which the Apostles themselves failed to do!” Such reasoners, disappointed in not finding wide-open licentiousness, withheld credit for a morality they did not wish to prac-

tise and a religion they undervalued or despised, and it was useless to argue against them.

Next came the long voyage to New Zealand, thence to Australia and down to Tasmania, or Van Diemen's Land as it was called then. Then another long voyage into the Indian Ocean, to the Cocos or Keeling Islands and Mauritius. South again to round the continent of Africa at Cape of Good Hope. North into the Atlantic, to St. Helena, and across the Atlantic again to Brazil, to complete the voyage round the world and the chronometrical measurements which were one of the chief objects of the *Beagle's* voyage.

On August 19, 1836, the *Beagle* left Brazil for home, and Darwin thanked God that he would never again visit a slave country. In his *Journal* he also pays his respects to that institution in words which let us far into the character of this now twenty-seven-year-old naturalist who in later life was to be execrated as an enemy of religion: "Those who look tenderly at the slave-owner and with a cold heart at the slave, never seem to put themselves into the position of the latter;—what a cheerless prospect, with not even a hope of change! Picture to yourself the chance, ever hanging over you, of your wife and your little children—those objects which nature urges even the slave to call his own—being torn from you and sold like beasts to the first bidder! And these deeds are done and palliated by men, who profess to love their neighbors as themselves, who believe in God, and pray that his Will be done on earth!"

We do not have to read between the lines of Dar-

win's letters to guess how much he had suffered from homesickness in spite of his devotion to his pursuits, or what it meant to him to be home again. With the voyage nearing its end, he had written his sister that, if the home folks could know the glowing, unspeakable delight which he felt at being certain his father and all of them were well, they would not grudge the labor lost in writing him regularly. He was delighted to think that he would see the leaves fall and hear the robins sing next autumn at Shrewsbury. His feelings were those of a "schoolboy to the smallest point," and he doubted if boy ever longed for his holidays as much as he did to see them all again. Everything about Shrewsbury was growing in his mind bigger and more beautiful.

When a change in the *Beagle's* course postponed their return several months, he wrote that he loathed and abhorred the sea and all the ships that sailed on it. The Commodore of the Fleet had bungled and carried off their home mail which they were due to receive in a certain port; Darwin wished he had the old Commodore to "shake some consideration for others into his old body."

After short calls at the Cape Verde Islands and the Azores, the *Beagle* made Falmouth on the 2d of October, 1836, and two days later Darwin reached his home in Shrewsbury, from which he had been absent five years and two days.

Was the voyage a profitable one? Darwin had no doubt on this point. His expenses had not exceeded two hundred pounds a year. Early in the voyage

he had expressed his belief that it would produce its "full worth in natural history" alone. Such a fine opportunity for studying geology and the infinite host of living beings was a prospect to keep up the most flagging spirit. If he were to throw it away he did not think he should ever rest quiet in his grave, but would be "a ghost and haunt the British Museum." Years later he wrote Fitz-Roy that the voyage was the most fortunate circumstance in his life and that he would not exchange what he had learned of natural history for twice ten thousand pounds a year!

But in casting up the advantages and disadvantages and the pains and pleasures of the long voyage, he felt that the actual pleasures did not counterbalance the evils. Only by looking forward to the harvest, when some fruit would be reaped, some good effected, could a true balance be struck. Obviously, Darwin never doubted that he would reap some fruit and effect some good! That anticipation outweighed the "obvious losses"—the old friends and the sight of those places with which every dearest remembrance is so intimately connected. Other losses also took heavy toll—want of room, seclusion, rest, the jaded feeling of constant hurry, privation of small luxuries, loss of society, music, etc. As to the boasted glories of the illimitable ocean, he agreed with the Arabian poet that it was a tedious waste and a desert of water. But there were some delightful scenes; for example, "a moonlight night, with the clear heavens and the dark glittering sea, and the white sails filled by the

soft air of a gently-blowing trade-wind: a dead calm, with the heaving surface polished like a mirror, and all still except the occasional flapping of the canvas."

The difference between savage and civilized man could only be characterized as the difference between a wild and a tame animal. One liked to look at a savage just as one liked to see a lion in the desert, a tiger tearing his prey in the jungle, or a rhinoceros wandering over the plains of Africa. To his boat cruises and land journeys through unfrequented countries he looked back with such delight as could be created by no civilized scene.

The discipline of the trip taught him an eternal lesson in good-humored patience, freedom from selfishness, the habit of acting for himself and making the best of every occurrence. Then, too, he had discovered so many truly kind-hearted strangers ready to offer him disinterested aid.

Writing to Henslow from Patagonia, where he had just heard of the fossil bones of a mammoth ("which shall be mine if gold or galloping will get them"), he spoke of his "bulky" notes—"about 600 pages, half geology." And the voyage was only well begun! The bulk of these notes at the close of the voyage can easily be imagined. As opportunity offered, Darwin would mail a copy home to supplement his letters. He once read some of his notes to Fitz-Roy, who remarked that they were worth publishing. "Here," thought Darwin, "was a second book in prospect," for his sister had already written him that

Henslow had had printed some of his letters which had been read before the Cambridge Philosophical Society. That same letter, by the way, informed him that Sedgwick had predicted to his father that he would take a place among the leading scientific men—which, as he recalled forty years later, had made him climb the mountains of Ascension with a bounding step, and the volcanic rocks ring under his geological hammer!

These “notes” were really a journal, a day-by-day running account of the more important incidents and observations made on the voyage. Having prepared them with care, they were soon ready for publication—a volume of some 200,000 words called the *Journal of Researches into the Natural History and Geology of the Countries visited during the Voyage of H.M.S. Beagle around the World*. But as it was printed as one of the volumes of the *Voyages of Her Majesty's Ships Adventure and Beagle*, he received nothing but presentation copies.

The *Journal* was reprinted in 1845 in the Colonial and Home Library under the title *A Naturalist's Voyage Round the World*; but Darwin had sold the copyright for £150—one of the worst bargains he ever made, for more than 10,000 copies were sold in England alone. The success of that “first literary child,” he wrote long after, “always tickles my vanity more than that of any of my other books.” And with characteristic modesty he was “surprised” at its popularity so many years after publication. It was translated into French, and into German at

the instigation of Liebig and Humboldt, filling him with "unpardonable vanity."

An early reviewer of the *Journal* spoke of the charm that had been thrown over its virgin pages, a charm that could only come from the freshness of heart of a strong intellectual man and an acute and deep observer. That charm can never fade, and nowhere is it more strikingly revealed than in his description of the roar of a mountain torrent carrying thousands of stones hurrying in one direction: "It is like thinking of time, when the minute that now glides past is irrecoverable. So it is with these stones; the ocean is their eternity, and each note of that wild music tells of one other step towards their destiny." The *Journal of the Voyage of the Beagle* has become a classic—and forms one of the volumes of Dr. Eliot's famous Five-Foot Shelf of Books.

And of all the scenes Darwin beheld on that voyage none impressed him more deeply than the "sublimity of the primeval forests undefaced by the hand of man; whether those of Brazil, where the powers of Life are predominant, or those of Tierra del Fuego, where Death and Decay prevail. Both are temples filled with the varied productions of the God of Nature:—no one can stand in these solitudes unmoved, and not feel that there is more in man than the mere breath of his body."

The God of Nature: Darwin had met Him face to face, in forests primeval where Life predominates and where Death prevails; and he was moved. But whither? Did Darwin himself know? Was there

ever a time since he was eight years old that he did not know the way he wanted to go? He certainly knew when he stepped on England's soil and turned toward Home. But did the father also know? Had sister Catherine shown him his letter of May 22, 1833, from Maldonado?

CHAPTER V

THEREAFTER SCIENCE CLAIMED HIM AS ITS OWN

I remember when in Good Success Bay, in Tierra del Fuego, thinking that I could not employ my life better than in adding a little to Natural Science.

DARWIN'S AUTOBIOGRAPHY.

UNCLE JOS was right. The five years abroad had not damaged Charles a bit; on the contrary, he was steady enough to be a clergyman, and certainly knew as much natural history as a clergyman was expected to know in that Early Victorian Age when clergymen were supposed to be scholars as well as gentlemen.

Why, then, didn't Charles become a clergyman? If his father had been asked, he probably could not have answered. The idea, with him, seems to have died a natural death. As for Charles, we can be certain that he had quite divorced the idea when he wrote Fitz-Roy that the day of his sailing would be as a birthday ever after, for on that day his second life would begin. That great voyage was definitely to mark the beginning of a career. He had jumped at the chance of the journey because his interest in travel had been aroused by the *Wonders of the World* and by Humboldt; but, deeper than that, because it would afford him relief from his father's wish that he become a clergyman and let him carry out the passion

inspired by his mother, to explore Nature. To sail on the *Beagle* was to resume his life's interest where it had been cut off at his mother's death—his second life was to begin.

But how did the father receive this son who had gone away a potential black sheep and had returned famous in scientific circles? How did this father, who had almost "supernatural insight into human nature," "unbounded power in reading character," this "most acute observer and wisest man," welcome his illustrious son? Did he recognize him, was there any fatted calf killed? Not that we can discover, nor does it appear that the father ever acknowledged that he had guessed wrongly as to what the journey would do for his son. It does not appear that he even addressed any remark at all to his son, but after looking him over turned to one of his sisters and exclaimed: "Why, the shape of his head is quite altered!"

Darwin thought that, although his father did not believe in phrenology, he was of "so skeptical a disposition and so acute an observer" that he must have recognized that his son's mind had developed during the voyage. Did Darwin himself believe in phrenology at that time? Probably not; but he certainly believed that his "mind" had developed and that so shrewd an observer as his father must have detected the fact in the altered shape of his head. And it is just possible that all the father meant to say was: "Why, the boy's got a swelled head!"

In any event, there is no evidence that the father

asked his son's forgiveness for having so misjudged him. That would have given the son an opportunity to meet his father on a new and saner footing. For be it remembered that Darwin before the voyage was considered by his father as headed toward no good end, and that he had opposed the voyage because it would render the son forever unfit to settle down, and because it was a wild scheme, merely another more extended sporting adventure. But the father must have known in a hundred ways and from a dozen sources that no one could have lived a less wasteful and idle or a more serious and sober life than Charles had lived for five years. What an opportunity for retraction, and what an incentive to make honorable amend!

How the son would have reacted to such a frank retraction on his father's part we do not know. We do know that the son so respected his father that he gave no evidence of chagrin at his father's evasive greeting. On the contrary, he leaned over backward, and judging from his autobiography recompensed himself for his disappointment by giving his father credit for more acuteness of character than we have any reason to believe he had from what we know about him. The son's submission to his father's dominance was complete and so remained even after his father's death. The father thereby became a dominating force in moulding Darwin's character and in determining his attitudes toward both superiors and inferiors. He was always respectful to the opinions of his elders, and more than sympathetic toward

every young man in want of help, advice, or encouragement. Having renounced any claim to equality with his father, he could devote his life to the one ambition which sprang from his first great love—and he did it so well that he raised himself to such a pinnacle that the father thereafter faded from the picture. The words “clergyman” and “Holy Orders” seem never again to have been mentioned by the family.

Conceivably, the stage was so set by the time of Darwin’s return and his own rôle so well rehearsed that nothing his father could do would have prevented him from going on with the play; the most the father could do would have been to postpone its opening. He did not try—and for that the world should be grateful to him, even as we know Charles was grateful.

The stage was the “temples filled with the varied productions of the God of Nature”; Darwin’s rôle was to interpret these “productions.” That, he had decided in Good Success Bay, was as good a rôle as he could play in life. And, be it understood, this was no afterthought of 1876—he wrote Catherine in that 1833 Maldonado letter that it appeared to him that “the doing what *little* we can to increase the general stock of knowledge is as respectable an object in life as one can in any likelihood pursue.”

He had failed in his father’s eyes to make good either as medicine man or preacher. To do his “little” in natural science would be his answer to that “failure”; he knows of nothing better he can do, and no one could pursue a more “respectable” object.

Medicine and the ministry were respectable, but they did not gratify his first great curiosity in life—to know the “why” of things, to know the origin of boys and girls. To consecrate his life to science would be compensation for his father’s wish that he do something worth while; to observe, to explore, to investigate, would be to keep faith with the wish of his beloved mother.

By the time Darwin landed in England his life work had become inevitable. He plunged into it. And what a life it became! Like a ceaselessly flowing river, ever broadening and deepening, bearing on its bosom an ever-increasing burden of responsibility, and ever bearing it cheerfully, faithfully, and lovingly, often against great obstacles. And, if we may continue the simile further, that river never became turbulent or muddied, but remained calm, fresh, clear to the end. For Darwin’s remained a virgin mind, open to new ideas, new books, new friends, new observations, new hypotheses, new laws. In a word, Charles Darwin never grew old. Even when slowed down by old age and sickness, we shall find him as we found him at the age of eight—curious, eager-eyed, wanting to know what makes the wheels go round.

The story of his life becomes increasingly complex, but complex only in the diversity of interests—of home, of children, of friends, of investigations, of publications, of manipulating the objective world, both as revealed to his eyes as objective phenomena and as descriptions in words. And possibly no man

ever lived less fearful of consequences, because behind his overt behavior in word and deed was the consciousness that he had played the game to the best of his ability, and that the game he played had value for the human race.

At times his life flows so fast that we shall have hard work to keep up with it; at all times it is so deep and broad that to describe it at any one point in time would be to lose sight of the fact that while we have stopped to describe, the current of his life has moved on. It is like trying to analyze protoplasm in a test tube—by the time we get it in the test tube it is dead; and dead protoplasm has given no one the slightest understanding of the infinite complexity of a single molecule of living protoplasm.

Having made the fullest compensation possible for his father's shortcomings, Darwin was now to plunge into his researches fairly free of distracting conflicts. The two years and three months which followed were the most active he ever spent. Back and forth from Shrewsbury to Maer, Cambridge, London; unpacking, repacking, meeting new friends, greeting old friends; preparing for publication; and making love to a certain young lady in Uncle Jos's house: those must indeed have been busy days!

Two days after his arrival home we find him declaring to that "kindest friend that ever man possessed," Henslow, that he is in the clouds and knows neither what to do nor where to go; nor can he write more for he is giddy with joy and confusion. To his Uncle Jos he hopes soon to "report in person" to

thank him as being his "First Lord of the Admiralty"; and adds that he is so very happy he hardly knows what he is writing. He could not have written as he did to Henslow and Josiah Wedgwood had he not been completely adjusted to circumstances.

Early in December he moved to Cambridge—a few days with the Henslows and then in lodgings. There he spent three months unpacking and distributing such parts of his South American collections as had been sent to Henslow. And it may be noted here that he presented all of his priceless collections to the museums of Cambridge and London.

He spent a good deal of time in his old College, Christ's, and was evidently made a member of the "Room." His name occurs frequently in the Combination Room wine book, where fines and bets were recorded, always paid in wine. Thus under February 23, 1837, Mr. Darwin made a bet with Mr. Baines as to the height of the Combination Room ceiling from the floor; Mr. Darwin lost; and that same day paid his fine: "1 bottle."

Forty years later Darwin's old university broke its rule of giving no honorary degrees to its own graduates and conferred on him an LL.D. degree. With it went an ovation and fitting horse-play by the undergraduates, who dangled from the gallery the figure of a monkey and a link of a huge chain—the "missing link"; the great man beamed with delight.

But Cambridge, with its good dinners and other temptations, was bad; so he settled in London early in March. London proved no better, and was likely

to grow worse! He took up lodging in Great Marlborough Street, where he remained till his marriage and where he finished the preparation for the press of the manuscript of his *Journal of the Voyage of the Beagle*.

In July of that year Darwin opened his "first notebook for facts in relation to the origin of species, about which I had long reflected, and never ceased working for the next twenty years." And that was his true love and accounts for his resentment at the inroads on his time made by dinner parties and society both in Cambridge and in London, and in fact by such frivolities for the remainder of his life. He declined the secretaryship of the Geological Society because, as he wrote Henslow, he could not look forward with any comfort to an undertaking he could not enter on with heart and soul; later he was persuaded to accept the office and held it for three years.

Even by this time he had discovered that intensive work on any one subject after a certain period of time fatigued him. He found he could get rest by mixing his diet. He read many books, even including metaphysics. He delighted in Wordsworth and Coleridge, and read and re-read *The Excursion*. Till then *Paradise Lost* had been chief favorite and his only companion on *Beagle* excursions when he could take but a single volume with him.

Of Darwin's new friends, the one who was thereafter to exert the greatest influence in his life was Lyell, the geologist; of him he saw more than of any other man both before and after his marriage. Above

all Lyell gave him encouragement, and in his autobiography and elsewhere Darwin acknowledges again and again his indebtedness to Lyell. And possibly his classic on *Coral Reefs* would never have seen the light of day if the hypotheses underlying that book had not met with Lyell's early approval.

Darwin's important works will be noted in their appropriate places. His minor publications, papers prepared for or communicated to scientific societies, are too numerous to be noticed individually, and a full list of them will be found in Appendix II. But two papers he prepared before he left London must be noted here.

One was a brief paper on the Formation of Mould, read before the Geological Society. With the expansion of that paper forty-four years later into a book which was to be read around the world, Darwin closed his career as an author.

The second paper, on the Parallel Roads of Glen Roy, "one of the most difficult and most instructive tasks I was ever engaged on," was to become a thorn in Darwin's flesh and plague him unmercifully. It was to be "instructive," but not in the way he thought. In that paper he attributed certain topographical features in Scotland to the action of the sea, but with the acceptance of Agassiz' glacial lake theory some ten years later he had to abandon his own explanation. He did not have to admit many mistakes in his long life of intense activity, but no one could be prompter or franker in such an admission than he was, however keenly he might feel it.

To Lyell he wrote: "I am smashed to atoms about Glen Roy. My paper was one long gigantic blunder from beginning to end. Eheu! Eheu!" He was "ashamed" of it and declared that he had learned a good lesson—"never to trust, in science, to the principle of exclusion."

This habit of open-mindedness, of readiness to be shown, of willingness to admit error, was his reaction to his father's rather obstinate nature and indifferent reception of the son who had done his best to please him and had already demonstrated that he was worthy of the respect of the most distinguished men of science in the land. The price he himself had had to pay for his father's lack of frankness, on that and other occasions, was one he would never exact from any fellow human being. In the Glen Roy matter he was shown to be in the wrong: "I admit it and am ashamed of it," was his prompt reply; and he never forgot the particular lesson that error taught him.

And yet this man, not yet turned thirty, with a hundred irons in the fire and with interests reaching out into every phase and field of natural science, could find room in his life for a wife and then make room for ten children.

Years after Darwin allowed in a letter to Asa Gray that, while children are one's greatest happiness they are often a still greater misery, and that a man of science ought to have none, and perhaps not even a wife—"for then there would be nothing in this wide world worth caring for, and a man might (whether

he could is another question) work away like a Trojan." But when it came to choosing a wife for himself, he appears to have selected the one woman in the world fit to be his wife and the mother of his children. He made no mistake when he proposed to the sister of the man who had married his sister Caroline, his cousin Emma Wedgwood. He certainly worked away like a Trojan with her; without her . . . ? Emma Wedgwood was a very remarkable woman; she should be as well known as any wife in history.

CHAPTER VI

HE MARRIED HIS COUSIN AND LIVED HAPPILY EVER
AFTER

A good wife is the supreme blessing in this life.

DARWIN, IN A LETTER TO A YOUNG MAN.

Remember what a good wife you have been to me.

DARWIN, ON HIS DEATHBED.

IN NOVEMBER, 1838, Darwin wrote to Lyell announcing his engagement to his cousin, Emma Wedgwood. It was "very unexpected good fortune" because he was not only connected with Emma by "manifold ties" but "by the most sincere love and hearty gratitude to her for accepting such a one as myself." Except possibly for the word "unexpected," Darwin meant exactly what he said; it was just like him to feel grateful to anybody who would marry him.

Darwin was a great writer and put huge enthusiasm into what he wrote, but his last letter to Emma before they were married has not yet found a place among the love lyrics of the world or in any manual on how to write love letters. It was written in the Athenæum Club in London on the night of Sunday, January 20, 1839:

. . . I cannot tell you how much I enjoyed my Maer visit, —I felt in anticipation my future tranquil life: how I do hope you may be as happy as I know I shall be: but it frightens me, as

often as I think of what a family you have been one of. I was thinking this morning how it came, that I, who am fond of talking and am scarcely ever out of spirits, should so entirely rest my notions of happiness on quietness, and a good deal of solitude: but I believe the explanation is very simple and I mention it because it will give you hopes, that I shall gradually grow less of a brute, it is that during the five years of my voyage (and indeed I may add these two last) which from the active manner in which they have been passed, may be said to be the commencement of my real life, the whole of my pleasure was derived from what passed in my mind, while admiring views by myself, travelling across the wild deserts or glorious forests or pacing the deck of the poor little *Beagle* at night. Excuse this much egotism,—I give it you because I think you will humanize me, and soon teach me there is greater happiness than building theories and accumulating facts in silence and solitude. My own dearest Emma, I earnestly pray, you may never regret the great, and I will add very good, deed, you are to perform on the Tuesday: my own dear future wife, God bless you. . . . The Lyells called on me to-day after church; as Lyell was so full of geology he was obliged to disgorge,—and I dine there on Tuesday for an especial conference. I was quite ashamed of myself to-day, for we talked for half an hour, unsophisticated geology, with poor Mrs. Lyell sitting by, a monument of patience. I want practice in ill-treating the female sex,—I did not observe Lyell had any compunction; I hope to harden my conscience in time: few husbands seem to find it difficult to effect this. Since my return I have taken several looks, as you will readily believe, into the drawing-room; I suppose my taste [for] harmonious colours is already deteriorated, for I declare the room begins to look less ugly. I take so much pleasure in the house, I declare I am just like a great overgrown child with a new toy; but then, not like a real child, I long to have a co-partner and possessor.

Nearly forty years later, in his autobiographical sketch, he wrote of that co-partner and possessor in these words:

You all know your mother, and what a good mother she has ever been to all of you. She has been my greatest blessing,

and I can declare that in my whole life I have never heard her utter one word I would rather have been unsaid. She has never failed in kindest sympathy towards me, and has borne with the utmost patience my frequent complaints of ill-health and discomfort. I do not believe she has ever missed an opportunity of doing a kind action to any one near her. I marvel at my good fortune that she, so infinitely my superior in every single moral quality, consented to be my wife. She has been my wise adviser and cheerful comforter throughout life, which without her would have been during a very long period a miserable one from ill-health. She has earned the love of every soul near her.

The sincerity and truthfulness of that declaration are attested by every act of Darwin's life and by every letter he ever wrote. In the finest sense of the word Emma Wedgwood became the co-partner and possessor of his house and of his life's interests.

No. 12 Upper Gower Street, the house Darwin spoke of in his letter to his fiancée, was one of a long row of drab brick houses. It is now No. 110 Gower Street. It has been acquired, with adjacent buildings, by the University of London, and will ultimately give way to college buildings. It is now used as a Club House for East Indian students. A tablet let into the wall commemorates the fact that the house was occupied by Darwin from the time of his marriage until the family moved from London to Down House.

Darwin moved into No. 12 Upper Gower Street on December 31, 1838, and was married on January 29th, the following month. We infer that he himself looked after the furnishing of the house, which he characterized as commonplace. The house apparently caused much merriment in the family, as they

laughed over the surprising ugliness of the furniture, carpets, etc., but it had "a good garden."

All that went on in that house in the three years and eight months that followed will never be known, and without that knowledge we cannot know why it was that Darwin did less scientific work than during any other equal length of time, nor why he had frequently recurring unwellness and one long serious illness. And yet work he did, and work hard. His *Coral Reefs* book cost him twenty hard months' work, in the preparation of which he read every work available on the islands of the Pacific and consulted many charts. In addition, he read many scientific papers and superintended the publication of the zoological volumes of the *Beagle* voyage. Nor, in his own words, did he "ever intermit collecting facts bearing on the origin of species."

But why this frequently recurring unwellness and the one long serious illness? Why, in the forty years that were to come, should he have been a more or less constant sufferer from insomnia, indigestion, nausea, vomiting, vertigo, and palpitation of the heart? And why, accompanying these physical disabilities, should he have become unable to endure society or worry of any sort? Did these visceral and somatic disturbances spring from the same source, and were they in turn expressions of a neurosis which had already begun to lead to visceral disturbances aboard the *Beagle*? Kempf in his *Psychopathology* so argues. He claims that Darwin suffered from a chronic anxiety neurosis induced by his relations with

his father; or, to put it another way, that the behavior of his father was enough to drive the young man crazy.

Darwin never did go crazy. By word and action he was able to readjust himself and live a life as sane and sound as was ever lived. But his viscera never became adjusted. In his eternal anxiety to be right, to be straight, to give his life to the only work he loved, he suffered exactly the same sort of anxiety an athlete does in anticipating an impending conflict. But the victory of the spirit over the flesh was so great that Darwin's life must forever remain a pattern of human behavior. In other words, the price he paid that the world of thought might be free may in a way be compared to the price Lincoln paid: Lincoln *with* his life; Darwin *all* his life.

This much seems certain: Darwin as a youngster was physically sound and able; of this we have not only indirect proof but the more positive evidence afforded by his capacity to shine as a sportsman at home and by the unusual powers of endurance he exhibited in the long and arduous overland excursions across the Patagonian wastes and the privations he endured in the long trips along the coasts of South America in open boats. It is not known that he ever suffered from any organic trouble. His illness has been diagnosed as chronic neurasthenia—which tells us nothing—and also as induced by eye strain. But some of his contemporaries ascribed his illness as entirely due to indigestion, which in turn had been

brought about by seasickness, together with fasting and fatigue on his long excursions.

Darwin himself refers to the matter in a letter to his brother Erasmus in 1864, but gives us no new light: "Fitz-Roy never persuaded me to give up the voyage on account of sickness, nor did I ever think of doing so, though I suffered considerably; but I do not believe it was the cause of my subsequent ill health, which has cost me so many years, and therefore I should not think the seasickness was worth notice." But whether it was chronic neurosis or chronic indigestion, the illness itself was real and led to suffering and disability as real as would the loss of a leg.

A few of the many references to his health in his correspondence will show his own reaction to it. In 1840, before he left London: "I am grown a dull, old spiritless dog to what I used to be. One gets stupider as one grows older I think." In 1845: "I believe I have not had one whole day, or rather night, without my stomach having been greatly disordered, during the last three years, and most days great prostration of strength; many of my friends, I believe, think me a hypochondriac." Some years later: "Do be wise and good, and be careful of your stomach, within which, as I know full well, lie intellect, conscience, temper, and the affections." And to Wallace: "For God's sake take care of your health." In 1863 he hoped that his life might be very short unless he could work a little, "for to lie on a sofa all day and do noth-

ing but give trouble to the best and kindest of wives and dear good children is dreadful." And still later: "I am very tired, and hate nearly the whole world. So good-night, and take care of your digestion, which means brain."

Darwin seems not to have minded the physical suffering or the actual illness so much as he did the fact that his illness slowed down his work. Thus to Huxley in 1872 he wrote: "We return home on Saturday, after three weeks of the most astounding dullness, doing nothing and thinking of nothing. I hope my Brain likes it—as for myself, it is dreadful doing nothing." The extent of the benefit he received, if any, from his frequent "hydropathic" visits is problematical. Water cures or "hydros" were then in great vogue and all-told Darwin spent many weeks taking the "cure." At best they effected no permanent change in his health.

One of Darwin's friends once asked his gardener about his master's health. "Oh!" he said, "my poor master has been very sadly. I often wish he had something to do. He moons about the garden, and I have seen him standing doing nothing before a flower for ten minutes at a time. If he only had something to do I really believe he would be better." Possibly the old gardener underestimated the significance of his master's "mooning" over a flower for ten minutes: he might have been writing a book—or he might have been thinking of the time when as a boy of eight he had looked into a flower to discover its name!

And finally, within a year of his death, he wrote Hooker that he was rather despondent because his discomfort made him idle and idleness was downright misery. He had no heart or strength to begin long investigations, the only thing he enjoyed; and as he had no little jobs he could do, he must "look forward to Down graveyard as the sweetest place on earth."

What a picture! His little chores were done, and he could not begin to battle with a new problem, the only thing he enjoyed!

When Emma Wedgwood promised to cherish Charles Darwin in sickness and in health, she evidently meant it. In the midst of one of Darwin's longest periods of discomfort she wrote to a cousin: "It is a great happiness to me when Charles is most unwell that he continues just as sociable as ever, and is not like the rest of the Darwins, who will not say how they really are; but he always tells me how he feels and never wants to be alone, but continues just as warmly affectionate as ever so that I feel I am a comfort to him."

Life in Upper Gower Street for a while was smooth enough and evidently to Darwin's liking, for in the autumn of 1839 he wrote to his cousin that they were living a life of extreme quietness and had given up all parties, which agreed with neither of them; "and if one is quiet in London, there is nothing like its quietness—there is a grandeur about its smoky fogs, and the dull and distant sounds of cabs and coaches." But children came along, and society (with both a big and little "S") clamored for his time and presence.

What he said in his autobiography was: "Such attendance [on society] suited my health so badly that we resolved to live in the country, which we both preferred and have never repented of." Which meant that his love for his investigations had become supreme—nothing should interfere with that work even though he had to become violently ill to save his time.

Wearied of house-hunting and from despair rather than from preference, they finally decided upon a beautiful old farmhouse, a quarter of a mile from the village of Down. There they moved on September 14, 1842, and within four years Darwin could write Fitz-Roy that his life went on like clockwork and he was fixed on the spot where he would end it.

Although almost within sound of the roar of London, it is hard to conceive of a spot in all England which seems more remote, isolated, or rural than the village of Down to-day; and it must have seemed even more remote nearly a hundred years ago. It lies just at the edge of Kent, in a fairly well-wooded, rolling, broken, chalk country, between two rather remote highroads connected by narrow, stony, tortuous lanes, worn deep from ages of travel—"mule paths" a German periodical called them.

The village itself consisted then, as it does now, of some forty houses and about 350 people. The three "streets" meet in the center of the village at the little church built of flint. While the house was being made ready Darwin and his wife stayed overnight in the village. The little pot-house where they slept

was a grocer's shop and the landlord was the village carpenter—"You may guess the style of the village," wrote Darwin to his sister. There was also a butcher and baker shop, and a post office.

When Darwin bought Down House, it was a great square three-story brick building covered with shabby whitewash and hanging tiles—"dull and unattractive," as were the garden and adjacent grounds, for the owner was not a scientist of great means but a farmer whose livelihood was his hayfield and his cows.

Darwin at once began to convert the place into a glorious English country home. To give the house better protection, he lowered the lane in front two feet, and used the earth from the excavation to build a couple of mounds in the great garden at the rear of the house, on which to-day stand fine old trees. Along the lane he then built a high flint wall, and filled the little plot between house and lane with shrubbery. He remodeled the house, covered it with stucco, and added to it on two different occasions.

To an American who had passed his early life in a farmhouse, it seemed a huge place. I counted no less than twenty-six rooms, twenty-three of which were provided with fireplaces. There were several bathrooms, that used by Darwin himself being about as big as a New York flat and provided with a fireplace. Running the whole length of the second floor is a great wide hall large enough for a bowling alley, probably the favorite playground of the children.

The back of the house is covered with tangled

creepers, and every window overlooks the green sward of a broad lawn with noble trees, beyond which was the twelve-acre "hayfield" and the long "Sand Walk." At the right are the extensive greenhouses where Darwin carried on innumerable experiments. At the left, beyond a huge ancient mulberry tree, are the vegetable gardens and servants' quarters. And on all sides are views across sparsely wooded chalk knolls, overlooking plowed fields and valleys. The whole place—house, lawns, gardens, meadow—produces an impression that only an English landscape can produce.

Much of the charm of the grounds and fields lies in the fine old fruit trees—cherry, walnut, pear, mulberry, quince, medlar, plum, and apple; and there were also purple magnolias, yew, Spanish chestnut, larch, and Scotch and silver fir.

Standing out sharply against the skyline, and beyond the meadow, is a long avenue of hazel, alder, lime, birch, privet, and dogwood trees—many of them planted by Darwin himself—with a sanded path down through the middle. This was the famous "Sand Walk." The Walk ends in a wide wild clump of tangled trees, in the midst of which, so thick is the vegetation, one could easily imagine oneself in the midst of a forest primeval. This was Darwin's favorite haunt, and here—alone, or with his children, or with friends—he took his regular turns each day.

There were flowers everywhere. Banks carpeted with pale blue violets and with primroses; copses beautifully enlivened with anemones; large areas

brilliantly blue with bluebells; sainfoin fields of the most beautiful pink and alive with buzzing bees. Larks abounded. Nightingales were common.

Improvements in the house and grounds were carried on intermittently for years. But the business of improvements was "bad for geology"; he could only manage to get a couple of hours' writing a day, and that not very regularly. It was uphill work writing books which cost money to publish and which were not read even by geologists, Darwin wrote Fox. Besides, there were twice as many temptations to extravagance in the country compared with London—"Ave Maria! how the money does go!"

Things other than money went into that house. Before its occupant quitted it to take up his final resting place in Westminster Abbey it had become a Mecca for naturalists, as it remains a shrine for worshippers of the truth. In that house the *Origin of Species* was written. Could it have been written without Emma Darwin?

Suppose Darwin had not had a rich father and had had to struggle for his bread and butter, as did Huxley; and having supposed it, we can only pass on to observe that he did have a rich father, that he was free from economic worry, and that he so guarded his patrimony and so appreciated the advantages of being economically independent that he once thanked God none of his children would ever suffer for want of bread and cheese.

What kind of wife would Emma Darwin have been had the wolf knocked at the door of that household

so much as once? Nothing that we know of her or of the home in which her character was formed gives us any reason to believe she would have proved less the wife than she was. And what a wife she was! Mother of ten children; hostess of heaven alone knows how many week-end parties to distinguished guests from the world's ends; week- and month-long visits from friends and relatives; and giving ceaselessly for forty years a marvelous exhibition of such qualities of a perfect wife as made it possible for Darwin to endure life.

No one except his mother, said Francis Darwin, knew the full amount of suffering Darwin endured or of his wonderful patience. For nearly forty years he never knew one day of the health of ordinary men; his life was one long struggle against the weariness and strain of sickness, and the wife was "the one condition which enabled him to bear the strain and fight out the struggle to the end." In the later years she never left him for a night; her days were so planned that all his resting hours might be shared with her; "she shielded him from every avoidable annoyance, and omitted nothing that might save him trouble, or prevent him becoming overtired, or that might alleviate the many discomforts of his ill-health." A lifelong devotion which could prompt such constant and tender care was indeed a "sacred" thing.

The point is that Emma Darwin made complete and perfect adjustment to her husband. To do that she gave up what many women would feel was more than should be expected of them—so much more,

in fact, that they could never become the perfect wife that Emma Darwin became. Even before marriage she foresaw that life with Charles meant either renunciation or dissension. She wrote to her aunt that there was a real crook in her lot: Charles dislikes going to plays, so "I am afraid we shall have some domestic dissensions on that head."

The Darwins saw much of general society in the early part of their London life, as well as many distinguished men of science. There were Lyell, Buckle, Sidney Smith, Dean Millman, Macaulay, Grote, Humboldt, and Motley, the American historian; even Carlyle was a visitor at their home. Carlyle, by the way, silenced the entire conversation at a dinner party by a long harangue on the advantages of silence; Darwin's comment was: "I never met a man with a mind so ill adapted for scientific research." It may also be recorded here that old Lord Stanhope at a London dinner party asked Darwin why he didn't give up his "fiddle-faddle geology and zoology and turn to the occult sciences"! Emma Darwin never made a request like that, but we may suspect that she did not give up the delights of London for the seclusion of Down without a pang. Nor did she give up the pleasures of excursions to the seashore without a protest. In fact, she very often had her own way.

Darwin wrote his very dear and close friend Hooker that he would not be able to try certain experiments for a while as his "despotic wife" insisted on taking a house in London for a month. We can easily guess

that there was no rancor behind the "despotic"; there is every indication, on the contrary, that Darwin did his best to meet his wife halfway in the matter of getting out, and when she put her foot down he went, like the decent husband he was, but the end of an excursion to London or the seashore was the occasion of a "Hurrah for home and quiet work!" Certainly her interest in and solicitude for her husband, at home or abroad, never relaxed—though we cannot conceive of her ever peremptorily stopping his working too much, as Mrs. Lyell stopped Lyell.

In the matter of snuff she was his "cruel wife," as he wrote Hooker. She had persuaded him to leave it off for a month, and as a result he felt almost "lethargic, stupid, and melancholy." Three years later the "cruel wretch" was again at it, he wrote Henslow; she had made him leave off "that chief solace of life." Although he had been presented with a fine snuffbox, he never carried it with him because of the ever-present temptation; he did not even keep snuff in his workroom, but in a jar on the hall table. The clink of its lid was a familiar sound in the house, as he would stop dictating and hurry out into the hall for a pinch. He had used snuff at Edinburgh, but acquired the habit at Cambridge, where the actual snuffbox used by Newton and Darwin, and which has never been allowed to become empty, is still passed around among the dons of Christ's College after dinner, and from which their guests are invited to take a pinch—as I can personally testify. The only time he smoked, apparently, was when rest-

ing, and then a cigarette, a habit he had acquired with the Gauchos of Patagonia.

What else did Mrs. Darwin do? Kept in touch as closely as she could with his scientific work and read the proofs of many of his books. No wonder that at seventy Darwin could write a young friend that he was heartily glad to hear of his intended marriage: "A good wife is the supreme blessing in this life, and I hope and believe from what you say that you will be as happy as I have been in this respect." But that marriage could not have been so perfect had not Darwin felt so much respect and affection for his better half. For example, he wanted very much to attend a certain meeting in London, but "I see from my wife's expression that she does not really much like my going, and therefore I must give up, of course, this pleasure." Or again, he had a cough which had made him miserable, but his "dear old wife insisted on my taking quinine, and though I have very little faith in medicine, this I think has done me much good." No doubt of his faith in his wife; he often said to her: "It is almost worth while to be sick to be nursed by you."

Francis gives us a little snapshot of family life that might be framed and hung above the radio: "After dinner he played backgammon with my mother, two games being played every night: for many years a score of the games which each won was kept, and in this score he took the greatest interest. He became extremely animated over these games, bitterly lamenting his bad luck and exploding with

exaggerated mock-anger at my mother's good fortune." "That score," he wrote Gray in 1875, "stands thus: she, poor creature, has won only 2490 games, whilst I have won, hurrah, hurrah, 2795 games." He thought Mrs. Gray might like to hear him boast—"it freshens them so."

Charles and Emma Darwin could and did get along with each other. Dull moments in that household are inconceivable. Only necessity of work, business, or illness, ever separated them. The following from a letter to his wife during such a separation reveals Darwin as perhaps no other letter does: "Yesterday, after writing to you, I strolled a little beyond the glade for an hour and a half, and enjoyed myself—the fresh yet dark green of the grand Scotch firs, the brown of the catkins of the old birches, with their white stems, and a fringe of distant green from the larches made an excessively pretty view. At last I fell fast asleep on the grass, and awoke with a chorus of birds singing around me, and squirrels running up the trees, and some woodpeckers laughing, and it was as pleasant and rural a scene as ever I saw, and I did not care one penny how any of the beasts or birds had been formed." They had been married twenty years when he wrote that letter. And we may suspect he got his keenest enjoyment in writing her how he had enjoyed himself. He found happiness in her presence and through her contentment and quiet gladness. When he was with her no more, she was to "remember what a good wife you have been to me"; and she was to "tell all my children to remem-

ber how good they have been to me.” And when she showed how distressed she was because he was in pain, he told her that he was sorry but could not help it. And when she lay down, presumably worn out, he said: “I am glad of it. Don’t call her.”

Emma Darwin was a marvelous wife, but was there ever such a husband as Charles Darwin—or such a father? Why shouldn’t those children have been good to such a father!

CHAPTER VII

HE WAS THE UNDERSTANDING FATHER OF TEN CHILDREN

He always made us feel that we were each of us creatures whose opinions and thoughts were valuable to him, so that whatever there was best in us came out in the sunshine of his presence.

DARWIN'S DAUGHTER.

WHAT a father Darwin must have been! His infinite patience, his never-failing kindness and gentleness, his huge understanding of his children! His father had misunderstood him; he would make certain that he did not misunderstand his own children.

In spite of Darwin's long periods of physical distress, and apart from the anxiety over sick children and the grief caused by the death of two children, conceivably there was never a more closely knit or happier family on this earth. It was a privilege to be born into that household and an honor to be invited as its guest. No bickering, no littleness, no petty quarrels, no grudges—that family was a going concern all the time. The children were keen, eager-eyed, and, above all, intelligently trained to become sane and intelligent members of society.

There were ten children in all—six sons and four daughters, all born within a period of seventeen

years. The first son, William Erasmus, born in 1839, was a Southampton banker and died at the age of seventy-three. The last son, Charles Waring, born in 1856, lived only two years. George Howard born in 1845, Francis born in 1848, and Horace born in 1851, were knighted and became Fellows of the Royal Society. Leonard, born in 1850, was educated at Woolwich, entered the Royal Engineers, and is a retired major. He was president of the Royal Geographical Society and is president of the Eugenics Education Society. Sir Francis was a botanist of note. Sir Horace was mayor of Cambridge and is chairman of the Cambridge Instrument Co. Sir George was second wrangler and professor of astronomy at Cambridge, "prince among the mathematical physicists," and author of original views on the evolution of the universe and solar system. Bernard Darwin, who visited America a few years ago as a member of a British golf team, is the son of Sir Francis. He is the author of several books on golf and is on the staff of the *London Times* and *Country Life*. A son of Sir George and a son of Sir Horace became Fellows of the Royal Society.

These details in themselves have no bearing on the evolution of Charles Darwin; they are given here for the benefit of those who like to think that talent is transmitted through germplasm. In fact, a Darwin stud-book is found in almost every work on eugenics, cited to bolster up the claim of transmission of talent. The trouble with that theory is that it is too simple and always fails in a pinch.

Darwin himself was more than once the sport of fate; it is hardly too much to say that he became a scientist in spite of his germplasm. But growing up in that household as his sons did, what could be more natural than that one of them should have learned to love flowers and become a botanist, and another get impatient at the kind of scientific instruments his father had to put up with and manufacture better ones? To discover why the grandson Bernard went in for golf and journalism, we must again look to the social environmental factors which shaped his career. What seems perfectly obvious is that the children of a mother who could not only bear ten children but find time to mother them, and of a father who not only explored the known living universe but found time to romp with his children, play backgammon with their mother, and in general sympathize with their desires and understand their whims, could not help but achieve some measure of success: they were trained; they learned useful habits, social ways. In other words, the boys and girls who grew up in the Darwin household so learned to walk and talk straight that they could not walk or talk any other way.

Nor should it be forgotten that because of the uniqueness of the father's opportunity in finding the world unexplored, and because of the thoroughness with which he explored it, he reached to the stature commonly called genius; and no matter how great any one of his sons might become in any one or any half dozen respects as naturalists, they were no longer

sailing unexplored and uncharted seas. There has been only one Charles Darwin. Half of his uniqueness was the uniqueness of his opportunity. William and George and Francis and Leonard and Horace are completely overshadowed by their towering father, yet each played a useful and by no means insignificant part in carrying on the family tradition.

Of the four daughters, one died within a year and another at the age of ten; one died at the age of seventy-nine; and Henrietta Emma, born in 1843, is still living.

In most respects Darwin was the most modest of men; the one great exception seems to have been his pride in his children. His five-months-old first-born was so charming he could not "pretend to any modesty. I defy any one to flatter us on our baby, for I defy any one to say anything in its praise of which we are not already fully conscious."

As grandfather, his enthusiasm for children was unabated. Only three years before he died he sympathized with a friend in his admiration of his little girl: "There is nothing so charming in this world, and we all in this house humbly adore our grandchild, and think his little pimple of a nose quite beautiful."

"But please to observe when I have a tenth, send only condolences to me. We now have seven children, all well, thank God, as well as their mother; five are boys; and my father used to say that it was certain that a boy gave as much trouble as three girls; so that *bona fide* we have seventeen children."

The most intimate of all the pictures of that house-

hold is found in a little passage written by Darwin himself a few days after the death of his ten-year-old daughter Annie. "Even when playing with her cousins, when her joyousness almost passed into boisterousness, a single glance of my eye, not of displeasure (for I thank God I hardly ever cast one on her), but a want of sympathy, would for some minutes alter her whole character." What an amazing example of love and discipline in that one sentence!

Annie would spend half an hour arranging his hair, "making it beautiful." When so exhausted she could hardly speak, she could still refer to the tea as "beautifully good"; and at the end, when her father gave her some water, she spoke her last words: "I quite thank you." She was the "joy of the household, and the solace of our old age. She must have known how we loved her. Oh, that she could now know how deeply, how tenderly, we do still and shall ever love her dear joyous face! Blessings on her!" And again: "Her dear face now rises before me, as she used sometimes to come running downstairs with a stolen pinch of snuff for me, her whole form radiant with the pleasure of giving pleasure." Her manners were "remarkably cordial, frank, open, straightforward, natural, and without any shade of reserve." Why should any child of Charles and Emma Darwin be reserved in cordiality, frankness, openness, straightforwardness, and naturalness?

Only a father whose heart is bound up with his children and who does not know what it is to flinch responsibility, can appreciate Darwin's anxiety when

his children were sick. Annie had died of scarlet fever, and to the day of his death he would never forget his sickening fear about the other children. A year later scarlet fever again struck that family, including his wife, and he exclaims: "Good God, what an illness scarlet fever is!"

In another letter he wrote: "Nothing is so dreadful in life as this fear; it still sickens me when I cannot help remembering some of the many illnesses our children have endured." He spoke of chloroform as a "blessed discovery"—"when one thinks of one's children, it makes quite a little difference in one's happiness." He had another reason for blessing chloroform—he had had "five grinders out at a sitting under this wonderful substance, and hardly felt anything."

Francis, writing after his father's death, expressed the belief that he never spoke an angry word to any of his children in his life, and as being certain that it never entered their heads to disobey him. His father once reproved him for a bit of carelessness and he felt depressed; but the father soon afterward took care to disperse the depression by speaking to him with especial kindness. Another son has related how his father once got angry because they were fooling; "the next morning at seven o'clock he came to my bedroom and said how sorry he was that he had been so angry and that he had not been able to sleep; and with a few kind words he left me." Seeing how undemonstrative the English are, Francis wonders that his father could have kept up such a delightfully

affectionate manner toward his children. When he had become a man he often wished his father would pass his hand over his hair as he used to do when Francis was a boy.

He laughed with and at his children as children and as grown-ups, and managed to keep on terms of perfect equality with them. He was always interested in their plans and success, always inclined to take a favorable view of their work. They never wrote him a letter or read aloud to him without receiving kind words of recognition.

He loved to see his grandson's "little face opposite to him"; and at meal times the grandfather would compare tastes with the youngster as to whether they liked brown sugar better than white, etc., and they would always agree!

The intimacy between father and children was so great and they valued him so highly as a playmate that a four-year-old son once tried to bribe him with sixpence to come and play with them in working hours!

And what a patient and delightful nurse he must have been! A daughter speaks of the "haven of peace and comfort it seemed to me when I was unwell, to be tucked up on the study sofa, idly considering the old geological map hung on the wall. This must have been in his working hours, for I always picture him sitting in the horsehair armchair by the corner of the fire." And she speaks of his unbounded patience in suffering raids into his study for sticking plaster, string, pins, scissors, stamps, foot

rule, or hammer; such things could always be found in the study. The children felt it was wrong to go in during work time, but when impelled they went. Once with a patient look Darwin said: "Don't you think you could not come in again, I have been interrupted very often." They also went to his study for sympathy and advice. In fact "the only place where you might be sure of not meeting a child was the nursery."

Imagine the stories Darwin could tell his children about his experiences during that five-years' voyage around the world on the *Beagle*! And he did tell them such stories. And about his school life and boyish tastes in Shrewsbury days. And he read aloud to them such books as Scott's—and gave them lectures on the steam engine!

While he cared for his children's pursuits and interests, respected their liberty and personality, and lived their lives "in a way that very few fathers do," none of his children felt that that intimacy interfered with their respect for or obedience to him. "He always put his whole mind into answering any of our questions." And what he said was truth and law to them.

"Our father and mother would not even wish to know what we were doing or thinking unless we wished to tell. He always made us feel that we were each of us creatures whose opinions and thoughts were valuable to him, so that whatever there was best in us came out in the sunshine of his presence." And they rejoiced in that sense of freedom. This

daughter need not have added that his overemphasis of their good qualities did not make them "conceited"—but "rather more humble and grateful to him," for it is true, as the daughter argued, that his sincerity and greatness of nature and character in general exerted so great an influence on them that his praise or admiration could not cause them to be vain.

And yet he was always one of them, and they always felt that he was one of them. There was no gulf between them: no abject reverence or paralyzing fear on their part; no stupid condescension or lordly patronage on his. He played with them, they worked with him. There were long walks, romps on hands and knees, games. Down House was a *home*. A more attractive or more hospitable home can hardly be imagined. The head of that home was the kind of father that children would just naturally love. They had no reason to be afraid of him. Nor did the young squirrels which ran up his back and legs. He had a genius for spotting birds' nests. And he would watch the children play lawn tennis, gathering stray balls for them.

Again and again in his letters to friends we get glimpses of the extent to which he entered into his children's lives and of their welcome to share his own interests. They were collectors of things which had social value in the family life. One of the youngsters loved to collect grasses and at the dinner table one night handed himself a little bouquet with the remark: "I are an extraordinary grass finder"!

When Darwin was absorbed in his huge work on

Cirripedia his children evidently got the idea that the proper study of mankind was Barnacles; the apparent idleness of a visitor to Down House impelled one of them to inquire of his mother: "When does Mr.—— do *his* Barnacles?"

When working on his theory of evolution by natural selection, one of his boys said to him: "If everyone would kill adders they would come to sting less." He answered: "Of course they would, for there would be fewer." The son replied indignantly: "I did not mean that; but the timid adders which run away would be saved, and in time they would never sting at all." Which Darwin called, "Natural selection of cowards!"

Three of Darwin's sons went to Cambridge University, and there was a family reunion so happy as to impel Sedgwick, Darwin's old master in geology, to write him: "I only speak honest truth when I say that I was overflowing with joy when I saw you, and saw you in the midst of a dear family party, and solaced at every turn by the loving care of a dear wife and daughters. How different from my position—that of a very old man, living in cheerless solitude! May God help and cheer you all with the comfort of hopeful hearts—you and your wife, and your sons and daughters!"

Just how to educate these children, it may be here noted, was a matter of great concern to the father. Going back over his own school days and the choice of professions urged on him by his own father, he could see no "ray of light." It made him sick, he

wrote to a friend, whenever he thought of "professions"—all seemed hopelessly bad. He thoroughly despised the old stereotyped stupid classical education, and yet he had not the courage to break fresh ground, and with grave doubt had started his oldest boy at Rugby. Just the same, he "honoured, admired, and envied" his friend for educating his boys at home.

Darwin could find time to carry on long investigations in many fields of science and to father his children as he did, because he had a great respect for time and never forgot how precious it was. He knew that the way to get work done was to save the minutes—to realize the difference between a quarter of an hour and ten minutes. By saving time, and by being careful not to have to do things twice or to read anything twice, his work was a pleasure and not a drag.

He was an early riser, and took a turn about the grounds before breakfast at 7:45. He then worked till 9:30, with letters and a bit of reading till 10:30. More work till noon; and, rain or shine, a turn out of doors. After luncheon, while lying on the sofa, he would read a newspaper, the only non-scientific matter he read to himself. There followed a work period till 4, sometimes in a huge horsehair chair by the fire, his paper supported on a board laid across its arms; or he would dictate from rough notes written out on the backs of manuscripts or scraps of paper. Another turn, generally in the Sand Walk, from four to half past, followed by an hour of work; idle till six,

the interval till tea time being filled with a novel read to him by some member of the family, and a cigarette. After a simple tea at 7:30, with an egg or a small piece of meat, came games, or some scientific book, or he would lie on the sofa listening to his wife play the piano. During the early years at Down House he sometimes played whist and billiards—the latter did him good and drove the “horrid species” out of his head. He once spoke of being “dull till whist, which I enjoy beyond measure.” He generally retired at ten—it might be to sit up for hours or lie awake in the feverish turmoil of his thoughts.

He replied to all letters, however foolish or unscrupulous, and always courteously. These letters give us, as they gave his son Francis, a feeling of his universal sense of kindness. He expressed surprise that so few people thanked him for his books, which he gave away so liberally.

The picture we have of him in the family circle in the drawing room, seated in his high chair, with his feet in enormous carpet slippers supported on a high stool, and listening to his wife’s music or the conversation of his family, seems destined to become as extinct as the Dodo.

Thus the days—week days and Sundays alike—passed into months and years. When he worked he worked, when he played he played, and when he rested he rested; and he allowed nothing that he could help to interfere with the daily routine of work, play, and rest. Only when persuaded by his wife were there holiday visits to the house of his brother

Erasmus or to his daughter—and then he would drive a bargain with his wife that they should return home in five instead of six days! The summer holidays were especially looked forward to by his children; his boys then saw more of him in a week than in a month at home. But he was never so happy as in returning home, not the least of his enjoyment being the welcome he got from his dog, wild with excitement.

Darwin was six feet tall, had long skinny legs, and in walking swung his arms back to open his chest. He usually carried a stick heavily shod with an iron ferrule. He gave the impression of activity rather than of strength. While at work he moved about quickly and easily, but he mounted stairs with a heavy footfall. He was bald, except for a fringe of hair at the back of his head.

He often lamented that he had not learned to draw well while in school and that he was not clever with his hands, but because he had such fine eye-hand coordination that he could kill a rabbit with a marble and a bird with a stone, he became expert with his dissecting instruments and with the microtome for the preparation of microscopic slides.

He is often pictured as holding one wrist with the other hand: this, according to Francis, was a habit. His bluish-gray eyes were deeply set behind overhanging bushy eyebrows. His forehead was high and wrinkled, but his face showed no signs of illness or worry. Charles Eliot Norton in a letter to Ruskin spoke of Darwin's massive face as characterized by expression rather than by beauty of feature; Leslie

Stephen thought him by far the most attractive of all the eminent men he had ever seen.

He wore loose, easy-fitting, dark-colored clothes, and is generally pictured under a soft black hat, which was replaced in summer by a big Panama. He affected a short cloak or shawl in winter, and cloth boots lined with fur. When he got excited at his work, he would remove his coat.

By all accounts, Darwin's talk, whether on grave or gay subjects, was animated, bright, and racy, without preachments or prose, and often punctuated with free and sounding peals of laughter. In explaining or describing, he made much use of his hands.

From his habit of using up all sorts of odds and ends of paper for his notes and memoranda, we get the idea of a kind of thrift which marked his life from the period of the *Beagle* voyage onward, but he could be extraordinarily generous, both with time and money, to his family and to men and situations he deemed worthy of support. He could do this and leave his family well provided for because he knew the value of little things. His carefulness and exactness in money affairs and in his business dealings were remarkable. He classified and balanced his accounts like a merchant.

His economy in paper was a hobby, but it sprang from respect for paper; it led him to use up much of the original manuscript of his books. He was liberal and generous in money matters to his children. He got much satisfaction out of the royalties from some

of his books. It became his custom to divide whatever surplus he had at the end of the year among his children. What a strange combination of thrift and generosity! To Lyell, on the receipt of his *Travels in North America*, he wrote: "I read only about a dozen pages last night (for I was tired with hay-making)!"

The adulation paid Darwin must have been enough to turn the heads of a dozen ordinary men and so elevate them in their own estimate of their importance as to make them more human and less humane. On one occasion at a dinner party he did reprove a lady who had been boasting about herself, with an: "Ah! how I should like to dissect you!" But a more revealing picture of the public's attitude toward him, and of his great gentleness toward strangers, is found in the words of Charles Kingsley on his first interview with Darwin: "I trembled before him like a boy, and longed to tell him all I felt for him, but dare not, lest he should think me a flatterer extravagant. But the modesty and simplicity of his genius was charming. Instead of teaching, he only wanted to learn, instead of talking, to listen, till I found him asking me to write papers which he could as yet hardly write himself—ignorant in his grand simplicity of my ignorance and of his own wisdom."

Francis speaks of his father "shooting" his hand out to his guests on their arrival, as though in his haste to greet them. How characteristic! How it illumines his attitude toward the world of men and things that he loved to explore—hastening to meet

them more than halfway! Week-end visitors enjoyed not only the hospitality of Down House but the freedom of their individuality. Their journeys were arranged for them, plans made when to come and when to go, and the hand shot out to welcome them when they arrived.

He was the loved and respected head of the house, polite to his servants, and so dreading to have to scold one that he could hardly trust himself to speak. Some of his servants were almost members of his family. An old nurse who was with him in his last illness had come from Shrewsbury forty years before; her uncle and aunt had been in his father's service. The butler especially was treated as one of the family and was so regarded by Darwin's friends.

Nothing was beneath his notice. Curious about everything, ambitious to know everything, he seems to have found time for everything, even to help found a Friendly Club shortly after he moved to Down; he was its treasurer for thirty years. On Whit Monday of each year the Club would march to Down House with banners flying and band playing, to pay their respects to and show their love for a man so great that he never forgot to be a human amongst humans. He was a County Magistrate for years, took an active part in all parish matters, was a liberal contributor to local schools, charities, etc. Little wonder that once as he entered a meeting of the Royal Institution in London the whole assembly rose to their feet en masse to welcome him!

How could he do it all! Respect for time was one

great factor. Then there is a line in a letter to Romanes which speaks for itself: "Trollope in one of his novels gives as a maxim of constant use by a brickmaker—'It is dogged as does it'—and I have often and often thought that this is the motto for every scientific worker."

What business had this man to be reading Trollope? After going through his letters one rather asks what didn't he read or have read to him! "Entire rest and *Adam Bede*" did him a world of good. Walter Scott and Jane Austen he read and reread. Many references to the more striking characters of Dickens show his familiarity with that great writer.

He liked his novels to end happily—that was his objection to the *Mill on the Floss*. He found *Silas Marner* a charming little story. He read Palgrave, Lecky, and Buckle. He was "delighted" with Prescott. He respected Sir John Lubbock's *Pre-historic Times* and was greatly grieved because he took to politics, thinking that science had lost him—"many men can make fair M.P.'s; and how few can work in science like him!" Tylor's *Primitive Culture* he enjoyed *extremely*; that judgment has stood the test of time. With equal insight he quarreled with Lecky, and thought that his use of such phrases as "spirit of the age," "spread of civilization," etc., produced a false appearance of throwing light on his subject.

On Wallace's advice he said he would get Henry George's *Progress and Poverty*. The subject interested him, but his earlier acquaintance with books

on political economy had produced a disastrous effect on his mind—to distrust his own judgment on such subjects and to doubt everyone else's. Evidently he was not very sanguine that *Progress and Poverty* would set him straight on political economy—"it will only make my mind worse confounded than it is at present."

The only language that had been of real use to Darwin in his scientific studies had not, of course, been presented to him in school, and so he had to force himself to learn German. That he could speak of it as the "*Verdammt*" shows how much he loved it, but he did hammer away at it with dictionary and great patience, and in the course of his life went through a huge mass of German scientific publications. Apparently he was not the only one who had to struggle with that tongue. He once boasted to Hooker that he was "beginning" it—to which Hooker replied: "Ah, my dear fellow, that is nothing; I have begun it many times."

Many writers have asserted that science is fatal to the esthetic sense—and they cite Darwin as the horrible example. The inference back of this fallacy (that a "taste" for certain kinds of music and for the so-called classics of literature, and including the esthetic arts, represents a "higher" or more "intellectual" type of "mind" than does a taste for chemistry or physics or biology or science in general) deserves attention. This inference is gratuitous and is a hangover from the Darker Days when the average man could not read or write and had a certain kind

of awe for the man who could. There was no science then worth mentioning; there were Shakespeare, Milton, and other "classics."

Darwin himself, commenting on the fact that up to the age of thirty he could read Milton, Gray, Byron, Wordsworth, Coleridge, and Shelley with great pleasure, lamented that in later life he could not read them at all and found Shakespeare "dull to the point of nausea." And he seems really to have lamented his "loss of higher æsthetic tastes." His interest in history, biography, travel, essays, etc., was as keen as ever, but his mind had become, as he put it, a kind of machine for grinding out general laws—"the higher parts of the brain atrophied." He was so impressed with this loss of "taste" that if he had had to live his life over again he would have made it a rule to read some poetry and to listen to some music at least once every week. The loss of such tastes, he thought, meant the loss of happiness, and possibly injured the "intellect" and even probably the "moral character." He thought that there might even be, as had been argued, a "natural antithesis between the mental conditions that respectively favour scientific and artistic excellence." It sometimes made him "hate science, though God knows I ought to be thankful for such a perennial interest, which makes me forget for some hours every day my accursed stomach."

But it certainly was no loss to Darwin's "intellect" (nor to his "moral character") that he could turn naturally from "literature" to science and find him-

self in the hitherto uncharted phenomenal world of facts, and could slough off some of his youthful emotional esthetic loves as a lobster sheds its skin; the tragedy was that he could not undergo this perfectly natural and wholesome change as painlessly as the lobster.

What could be more natural than that a man who had busied himself for the best years of his life in reconstructing continents and their mountains, plumbing oceans and their depths, and fathoming the entire scheme of life on this earth, should have lost his youthful enthusiasm for Milton's creating a lion out of some mud and talking about a whale as though it were a fish, or should find the plays Shakespeare wrote for the morons of his time "intolerably dull"?

Presumably we are still decades from the time when lives can be "artistic" without art and "esthetic" outside studios and without affectation. Even the *London Times Literary Supplement*, in 1909, in an article on Literature and Science, could so misinterpret Darwin's life as to put forth such a stupidity as: "If a man so utterly incapable of taking an intolerant or a contemptuous view of the life of art could yet find that his own work produced in him the decay of all faculty of artistic enjoyment, we have indeed a proof of the extent to which the two temperaments have diverged."

It was not that Darwin had lost something out of his life, but that something new and vastly greater had come into it; he had outgrown some boyish

habits. And when later in life he rested from his work of recreating the phenomenal world, what could be more natural than that he should turn to a first-class novel containing "some person whom one can thoroughly love, and if a pretty woman all the better"? And a novel was not first-class to him unless it did contain such a person, and end happily. Against novels with unhappy endings he thought a law ought to be passed. There were no Follies, movies, or radios then. He got relief and pleasure from novels—"I often bless all novelists."

Darwin was a naturalist; he was at home in the world wherever he found himself; and it came naturally to him to personify the world of Nature, to talk to it, admire it, scold it, love it. Francis tells us how he would speak in a half-provoked, half-admiring way of the ingenuity of a sensitive plant leaf in screwing itself out of a basin of water in which he had tried to fix it. Of some seedlings he said: "The little beggars are doing just what I don't want them to."

Why shouldn't he lose his respect for the dingy colors on the canvases seen in the galleries of London as he contrasted them with the bright tints he found in Nature? His attitude toward a little blue lobelia was not only that of a botanist, it was that of an artist as well. He not only admired the beauty of his flowers, he was "grateful" to the flowers for their beauty. He loved their delicate forms and colors. He would gently touch a flower which delighted him—"it was the same simple admiration that a child

might have." It was the same admiration he had had as a boy when he had learned to love flowers and be curious about them at his mother's knee.

He so loved his pigeons, of which he bred great numbers in connection with his investigations on the domestication of animals, that he could not bear to kill and skeletonize them; nor could he understand how a nobleman or gentleman, knowing anything of the pleasures to be had from Tumbler pigeons, could be without his aviary of them.

Of his love for dogs I have already spoken; it was a matter of great joy to him that his old rough white terrier Polly remembered him after his five years' absence on the *Beagle*. While he rode much as a boy, he never cared so much for horses as for his dogs, and had no high opinion of their intelligence. A horse once fell on him, and at another time he had a serious accident while riding; he lost his nerve and gave up riding altogether.

In spite of the fact that Darwin drank considerably during his Cambridge years, he shared the family tradition of a horror of drinking; for an Englishman of his time he might be called a teetotaler. But he kept up his boyish love of sweets; and a boyish trick of vowing not to eat them—but the vow would not be binding unless he had made it aloud!

Such was Charles Darwin in the bosom of his family. Such was the father those children learned to love and respect. Many children never learn that. In an animal so highly organized as Man there are no "instincts" for love or respect, either of parents

for children or of children for parents. Children learn to respect parents when parental behavior is such as to impel their respect. Loved parents are lovable parents. And comparable to his greatness as scientist was Darwin's greatness as husband and father. This greatness was not innate in him; it sprang from his huge understanding of his fellow beings, and that understanding was the outgrowth of his passion to know better the world into which he was born.

CHAPTER VIII

HE BECAME THE FRIEND OF ALL THE WORLD

Put my name down for fifty pounds. Pray use me as often as you like.

DARWIN.

WE HAVE seen something of Darwin's attitude toward his wife, his children, his community, his servants, and his pets; we are now to see him as the friend of all the world, the confidant of his intellectual companions, the open-minded seeker after truth, the opponent of shams, and the fighter of ignorance.

The real and the great contributions to science have been made by men who never forgot their humanity and made the most of it. Darwin's regard for the rights of his fellow men was not more than his respect for their prejudices. He could receive much because he had much to give, as he could learn much because he would not allow himself to forget his ignorance. Thus to see him as he was and as he seemed to his fellow men is to see him as one always prepared and always preparing to make long journeys into the unknown.

Darwin's children, as we have seen, often entered into his work and did not hesitate to argue with him; that stimulated him to further effort. Without the influence, support, encouragement, and sharp and friendly opposition of certain of his friends, his life

might indeed have been barren in much that made for a normal, sane, and joyous life. Possibly no great law of nature was ever thought out by one man talking it over with himself; he keeps trying it out on his friends, sharpening his wits against theirs.

Of all Darwin's friends "hardly any one was more lovable" than Sir Joseph Hooker, who followed his father as director of the great Kew Botanic Gardens. When young Joseph was working hard to take his degree that he might join the famous Ross antarctic expedition as surgeon, he got hold of the proof sheets of Darwin's *Journal of the Voyage of the Beagle*. He was so excited about them that he kept them under his pillow—that he might read them "between waking and rising." They impressed him profoundly, and he despaired at the variety of acquirements a naturalist needed to follow in Darwin's footsteps. They also stimulated him to enthusiasm and a desire to travel and observe. Thus does the ball of stimulus to know roll on. Humboldt's *Personal Narrative* had inspired Darwin's *Journal*; that, in turn, had aroused in Hooker a wave of enthusiasm to explore. Before he left England on his long voyage he met Darwin personally; and thus began a friendship of great mutual joy and of inestimable benefit to science.

That memorable first meeting took place in 1839 in Trafalgar Square, the introduction being made by one of Darwin's shipmates on the *Beagle* who happened to be walking with Hooker. Hooker was impressed by Darwin's delightfully frank and cordial sailor-like greeting of his old shipmate. It was a

permanent source of happiness to Hooker that he had known Darwin's "scientific work so long before the intimacy began which ripened into feelings as near to those of reverence for his life, works, and character, as is reasonable and proper." Darwin's regard for this friendship may be seen from a line in a letter to Hooker in 1860: "Talk of fame, honour, pleasure, wealth, all are dirt compared with affection; and this is a doctrine with which, I know from your letter, that you will agree from the bottom of your heart."

The chance meeting in Trafalgar Square quickly led to friendship. A few years later Darwin wrote: "What a good thing is community of tastes! I feel as if I had known you for fifty years." And forty-two years later, shortly before his death, he was again to write: "Your letter has cheered me, and the world does not look a quarter so black this morning as it did when I wrote before. Your friendly words are worth their weight in gold."

Hooker must have been a remarkable man and just the sort of correspondent and friend Darwin would appreciate. He could always count on Hooker's honest and candid criticism of his views; if they could not agree, as Darwin once wrote him, they must "come to swearing"—and he was convinced he could swear harder than Hooker!

In one letter to Hooker, Darwin congratulated himself on having an unfair advantage—in having extracted more facts and views from him than from any other person. And the way he "extracted facts"

was nothing short of genius; Hooker was not the only guest to be "pumped," as Darwin called it. Each day, after breakfast, he would bring out a pile of slips with questions to be answered, and would conclude by "telling me of the progress he had made in his own work, asking my opinion on various points. I saw no more of him till about noon, when I heard his mellow ringing voice calling my name under my window—this was to join him in his daily forenoon walk round the Sand Walk." But Hooker always left "with the feeling that I had imparted nothing and carried away more than I could stagger under." That was genius.

Hooker was the first and one of the very few to whom Darwin, early in 1844, confided his belief in evolution. He could make that confidence because it would be kept and because Hooker was not the man to accept meekly or blindly a new opinion. He was a "terrible worrier of poor theorists," and "thank God, one of the few who dare speak the truth." Hooker's photograph hung over the chimneypiece, beside that of the great geologist Lyell, and Darwin liked it "much; but you look down so sharp on me that I shall never be bold enough to wriggle myself out of any contradiction." But the sight of Hooker's handwriting "always rejoices the very cockles of my heart." Darwin "delighted" in the midst of his evolution work to have many points fermenting in his brain; Hooker's letters gave him plenty "of this same fermentation."

A few years after the publication of the *Origin*

of *Species* Darwin took Hooker to task for abusing himself, adding: "You thus abuse me, because for long years I have looked up to you as the man whose opinion I have valued more on any scientific subject than any one else in the world. I continually marvel at what you know, and at what you do . . . You will never know how much I owe to you for your constant kindness and encouragement." Darwin thought he owed Hooker ten times as much as Hooker owed him, and in about the last letter he ever wrote Hooker he said: "Your long letter has stirred many pleasant memories of long past days, when we had many a discussion and many a good fight."

Hooker's father-in-law was the great Henslow, the man Darwin had walked with in his Cambridge days, the man "I did not think I could venerate more than I did." Henslow's influence on Darwin's life was profound and far-reaching. Nothing further is needed to emphasize this point, but it is worth bearing in mind that from the first Darwin looked upon him as "a really noble and good man," and that he always left him in "a fit of enthusiastic admiration for his character."

An outstanding figure in Darwin's world was the great geologist Charles Lyell (1797-1875). It is difficult to say whether Lyell more influenced Darwin or Darwin Lyell. The understanding between them was as nearly perfect as human relations permit. Lyell had been Darwin's master; Darwin came to be his master. But Darwin never forgot how completely Lyell had revolutionized geology, nor did he

ever forget that "almost everything which I have done in science I owe to the study of his great works." He felt that his books "came half out of Lyell's brain," and he could never acknowledge it sufficiently.

The correspondence between the two men never ceased and their friendship matured with passing years. Lyell's curious antics and attitudes when excited were familiar sights at Down House. After one of these visits, when Lyell was working on his *Antiquity of Man*, Darwin wrote their mutual friend Hooker about having had a "splendid" talk with Lyell: "you may guess how splendid, for he was many times on his knees, with elbows on the sofa."

During the forties Lyell made two trips to the United States, and on each occasion brought out a volume of travels. The question of slavery was discussed in the first volume. The following passage from a letter to Lyell shows Darwin's attitude on this and other points: "As you would care no more for my opinion on this head than for the ashes of this letter, I will say nothing except that it gave me some sleepless and most uncomfortable hours. Your account of the religious state of the States particularly interested me; I am surprised throughout at your very proper boldness against the Clergy. In your University chapter, the Clergy and not the State of Education, are most severely and justly handled, and this I think is very bold, for I conceive you might crush a leaden-headed old Don, as a Don, with more safety, than touch the finger of that Corporate Animal, the Clergy."

Lyell's *Second Visit* was also read with "great interest," and had made one of the Wedgwoods "heart and soul" an American; "he wishes the States would annex us, and was all day marvelling how any one who could pay his passage money was so foolish as to remain here."

After long years Lyell became a convert to Darwin's theory of evolution and in a new edition of his *Manual of Geology* in 1859 admitted the principle of the modification of species. This prompted Darwin to write: "I honour you most sincerely. To have maintained, in the position of a master, one side of a question for thirty years, and then deliberately give it up, is a fact to which I much doubt whether the records of science offer a parallel."

But an even more impressive tribute to Lyell's honesty and frankness is a line in a letter from Darwin saying he is about to send him his forthcoming *Origin of Species*: "and if you approve of it, even to a moderate extent, it will be the highest satisfaction which I shall ever receive for an amount of labour which no one will ever appreciate."

Huxley never came into Darwin's life as did Henslow, Hooker, and Lyell; there was disparity in age as well as great difference in temperament and methods. But as early as 1851 Huxley had become so impressed by Darwin that in a letter to a friend he said "he might be anything if he had good health." And Darwin himself soon learned to respect Huxley's clear vision and concise way of putting things, and his valor as a fighter in every scientific cause. Huxley

was a not infrequent visitor at Down House and on one occasion at least was there for many days with his entire family—which was almost as numerous as Darwin's.

On Huxley scarcely less than on Hooker Darwin could try out his ideas and opinions. He was "the cheeriest letter writer" he knew. And honest in his criticisms, too, otherwise Darwin would not have bothered with him, or have spoken so affectionately of him after the great fight had begun as "my good and admirable agent for the promulgation of damnable heresies"; or have exclaimed after Huxley had had his famous set-to with the Bishop of Oxford: "God bless you!—get well, be idle, and always reverence a Bishop"; or have declared ten years later to Huxley that he cared for his opinion on a certain subject more than that of any other man in Europe—he was "so terribly sharp-sighted and confoundedly honest." To the very end of his days Darwin was mindful of the part Huxley had played in advancing the science to which he had devoted his life, and in establishing the belief in his theory of natural selection; nor was he ungrateful for the honors Huxley had piled "high and thick on my old head."

Asa Gray, the great botanist at Harvard, was Darwin's "Huxley" in America. In the entire realm of scientific correspondence there is no finer chapter than the correspondence between these two great simple souls.

Darwin met Gray at the Kew Botanic Gardens some years before the publication of the *Origin of*

Species. Recognizing his great ability, he began—and continued—to ply him with questions and exchange views on subjects of mutual interest. This soon ripened into a friendship which lasted throughout life. Darwin's respect for Gray was so great that, outside the realm of geology, he said he cared more for his and Hooker's opinion than for that of all the rest of the world.

And Darwin was not slow in asking. He opened one letter to Gray with: "This shall be such an extraordinary note as you have never received from me, for it shall not contain one single question or request." That letter must have been unique, for he began another with: "An Irish nobleman on his deathbed declared that he could conscientiously say that he had never throughout life denied himself any pleasure; and I can conscientiously say that I have never scrupled to trouble you; so here goes."

Gray was one of the "best reasoners and writers" Darwin had ever known. "He knows my book as well as I do." Hence the great value of Gray in America in advancing the cause of evolution. He brought to the question (of the origin of species) "new lines of illustration and argument in a manner which excites my astonishment and almost my envy! . . . Every single word seems weighed carefully, and tells like a thirty-two pound shot." Which for those days was quite a shot.

His enthusiasm in a letter to Gray fairly runs riot: "Your many metaphors are inimitably good. I said in a former letter that you were a lawyer, but I made

a gross mistake, I am sure that you are a poet. No, by Jove, I will tell you what you are, a hybrid, a complex cross of lawyer, poet, naturalist, and theologian! Was there ever such a monster seen before?"

Toward the close of 1861 it seemed possible that Great Britain would become involved in our Civil War, which prompted Darwin to write Gray: "What a thing it is that when you receive this we may be at war, and we two be bound, as good patriots, to hate each other, though I shall find this hating you very hard work. How curious it is to see two countries, just like two angry and silly men, taking so opposite a view of the same transaction!"

There was an exchange of views on the merits of the war. Darwin wrote: "The millennium must come before nations love each other; but try and do not hate me. Think of me, if you will, as a poor blinded fool." And three months later he asked: "When will peace come? It is dreadful to think of the desolation of large parts of your magnificent country; and all the speechless misery suffered by many."

Hooker, Henslow, Lyell, Huxley, and Gray were Darwin's great friends—great in their mutual respect, mutual understanding, mutual helpfulness. Without them there would have been great blanks in Darwin's life; without Darwin it is equally certain their own careers would have been different. Lyell began as Darwin's teacher; he became his pupil. Hooker and Gray were the two intimates to whom

Darwin could turn for help in collecting facts and for brains in testing his theories. Huxley was the great general in the field where religious convictions led to fierce and bitter antagonism and denunciation.

To these five names must be added one more, that of Alfred Russel Wallace, whose rôle it was to force Darwin's hand and to share with him the honor of the discovery of the theory of natural selection. How that came about will be told in its proper place; it is enough here to say that in the history of man's relationship with man there is no finer chapter than that which tells how these two great souls shared that honor and thereafter vied with each other in the generosity of their attitude toward each other. A single paragraph from one of Darwin's letters to Wallace reveals the character of both men: "Most persons would in your position have felt some envy or jealousy. How nobly free you seem to be of this common failing of mankind. But you speak far too modestly of yourself. You would, if you had my leisure, have done the work just as well, perhaps better, than I have done it."

One other line, written at the age of sixty, shows how Darwin's own early collecting days had been revived by Wallace's descriptions of his wanderings as a naturalist in the Malay Archipelago: "Your descriptions of catching the splendid butterflies have made me quite envious, and at the same time have made me feel almost young again, so vividly have they brought before my mind old days when I

collected, though I never made such captures as yours. Certainly collecting is the best sport in the world."

To these six friends and correspondents, add the civilized world. Darwin never hesitated to appeal to anyone for information; I cannot learn that anyone ever appealed in vain to him on any point or about anything. Out of this great mass of correspondence I have selected bits here and there which are typical of his generous nature and of his inquiring spirit.

One correspondent is "mistaken in thinking that I ever said you were wrong on any point. All that I meant was that on certain points, and these very doubtful points, I was inclined to differ from you." Another is asked to write if he has anything at all pleasant to write, and if not, to write it anyhow: "it will do you good to expectorate. And it is well known that you are very fond of writing letters. Farewell, my good old friend and enemy." He knows how busy another correspondent is, but "I shall have a good chance of your doing what I want, as it would be hopeless to ask a quite idle man." For the kind manner in which another has referred to his works he expresses his thanks, "and for the even still kinder manner in which you disagree with me." And to a German scientist he expresses his appreciation of his having shown how a man may differ from another in the most decided manner and yet express his difference with a most perfect courtesy; to which he added: "Not a few English and

German naturalists might learn a useful lesson from your example; for the coarse language often used by scientific men towards each other does no good, and only degrades science."

How strange, funny, and disgraceful, he wrote Hooker, that nearly all the great English men of science were in quarrels in couples. And referring to Owen's despicable underhand attack on him, he exclaimed: "What wretched doings come from the order of fame; the love of truth would never make one man attack another bitterly." In like vein, it seemed to him "a very striking fact that the Newtonian theory of gravitation, which seems to everyone now so certain and plain, was rejected by a man so extraordinarily able as Leibnitz. The truth will not penetrate a preoccupied mind." The profound insight shown in that last sentence is even more forcibly expressed in his: "A man who talks about what he does not in the least understand, is invulnerable."

It is the young men, he said, who are most likely to do good. It is the business of youth to be receptive to demonstration.

The old fogies in the Geological Society were so slow to judge of the truth that they would be "as injurious to progress as the French Institute"! He had little patience with the English public in not giving science a fair hearing, nor was his impatience confined to a gesture. He wrote to the English translator of Weismann's great work that he was sorry for the honor of England that the translation had sold badly; "if you yourself lost by it, I earnestly

beg you to allow me to subscribe a trifle, viz., ten guineas, toward the expense of this work." To another translator he wrote that he was afraid it was "too good for the English public, which seems to like very washy food, unless it be administered by some one whose name is well known, and then I suspect a good deal of the unintelligible is very pleasing to them. I hope to heaven that I may be wrong."

The same sentiment was expressed in a letter to Huxley when there was a movement on foot to remove the natural history exhibits from the British Museum. He could see many advantages in leaving the "unmotherly wing of art and archæology"; his "only fear was that we were not strong enough to live without some protection, so profound, I think, is the contempt for and ignorance of Natural Science amongst the gentry of England."

While he could ask Hooker to forfend him "from a man who weighs every expression with Scotch prudence," he could tell Robert Chambers that he would not fulminate so much against the skepticism of scientific men if he had had as many wild-goose chases after facts stated by men not trained in scientific accuracy as Darwin himself had had. "I often vow that I will utterly disregard every statement made by anyone who has not shown the world he can observe accurately." Without accuracy, he knew there could be no real progress in science. It was, he declared to a young naturalist about to go abroad, "the soul of Natural History. It is hard to become accurate; he who modifies a hair's breadth will never be

accurate. . . . Absolute accuracy is the hardest merit to attain, and the highest merit. Any deviation is ruin."

But merely to name a species was not to advance science. He did not think more credit due to a man for defining a species than to a carpenter for making a box. "But I am foolish and rabid against *species-mongers*, or rather against their vanity. . . . They act as if they had actually made the species, and it was their own property."

There could be no progress in science without theory. "About thirty years ago there was much talk that geologists ought only to observe and not theorize; and I well remember someone saying that at this rate a man might as well go into a gravel-pit and count the pebbles and describe the colours."

Darwin could not have been the friend he was of all the world if he had been less honest. Truth to him was religion, only the truth could set him free. His conception of truth was not to talk about it, but to act it, at whatever cost to his pride or even to his sleep.

Thus, at one of the parish meetings which Darwin attended when he was able, a dispute came up over some point of no great importance. That night Darwin called on the Vicar to say that, in thinking over the debate, although what he had said was accurate enough, he was afraid the Vicar might have drawn an erroneous conclusion—and he could not sleep till he had explained it. It was the Vicar's belief that if at any time any certain fact had come to Darwin's

knowledge which contradicted his most cherished theory, he would have placed it on record for publication before he slept.

During a general discussion one night at Down House regarding the evolution of human emotions, the question came up as to the recognition of beauty in natural scenery. Darwin incidentally remarked that he had been most moved by the sublimity of the scene from the summit of the Cordilleras. Some time later he retired; the others talked on. A few hours later Darwin appeared in slippers and dressing gown to say: "Since I went to bed I have been thinking over our conversation in the drawing room, and it has just occurred to me that I was wrong in telling you I felt most of the sublime when on the top of the Cordillera; I am quite sure that I felt it even more when in the forests of Brazil. I thought it best to come and tell you this at once in case I should be putting you wrong."

"Thinking over our conversation!" Most men go to sleep when they go to bed—they have nothing to think about. Thinking is work. Darwin was so full of his work that he could not leave it behind him as he did his boots. Possibly no man ever went to bed more heavily loaded with the objective world, or so intensely curious about it that he would manipulate it in words far into the night. Included in his "work" was a passion for truth—and justice.

Among the fads of Darwin's time were homeopathy, mesmerism, and spiritualism. It will not be hard to guess his attitude. Spiritualism so tran-

scended his belief that his ordinary faculties were put out of the question. Of a séance at the house of his brother Erasmus he exclaimed: "The Lord have mercy on us all if we have to believe in such rubbish!"

Homeopathy made him even "more wrath" because to believe in the efficacy of infinitesimal doses was to let common sense and common observation both go to the dogs. He was equally skeptical about mesmerism. He advised a friend to keep some cats and get a mesmerizer to attempt to mesmerize them: "One man told me he had succeeded, but his experiments were most vague, as is likely from a man who said cats were more easily done for than other animals because they were so electrical!"

A correspondent whose middle name was Jenner had to admit that he was in no way related to the great Jenner who discovered the vaccine of smallpox. "It is a pity," wrote Darwin, "for a Duke might be proud of his blood." And in his respect for the peerage Darwin was thoroughly English, or as he said to Lyell, he had the true English instinctive reverence for rank! He upbraided Hooker for being so "dreadfully severe" on the Duke of Argyll, though Darwin admitted he himself was not a fair judge, "for a Duke in my eyes is no common mortal and not to be judged by common rules!"

From which we might infer that he would have become an ardent supporter of the Eugenics Society his distant cousin Sir Francis Galton proposed to found in 1873. But Darwin was not "so hopeful." "There is much concealment of insanity and wicked-

ness in families; and there would be more if there was a register. But the greatest difficulty, I think, would be in deciding who deserved to be on the register. How few are above mediocrity in health, strength, morals, and intellect; and how difficult to judge on these latter heads."

The eugenics movement has not yet squarely met the question implied in that last sentence. It has not yet made certain of its facts—as Darwin more than fifty years ago insisted upon. Thus, in 1870, Darwin wrote Lubbock about the prevailing objection in England and elsewhere against the marriage of cousins because of the supposed injurious consequences. That belief, he said, "*rests on no direct evidence. It is therefore manifestly desirable that the belief should either be proved false, or should be confirmed*, so that in this latter case the marriages of cousins might be discouraged."

When Lubbock (Lord Avebury) was seven years old his father came home one evening quite excited, and said he had a great piece of news for him.

"A pony?"

"Oh, it is much better than that. Mr. Darwin is coming to live at Down."

That was in 1841. The Lubbock house was only a mile from Down. Lubbock's father was a rich banker, but Darwin persuaded him to buy a microscope for young John. Twelve years later, young Lubbock published his first "scientific original work"—it was on some of "his" collections. "His" was Darwin, of course. Darwin's coming to Down was

more than "great news"—it was the turning point in the life of young John Lubbock. And when he had become famous he continued to sign his letters to Darwin "Yours affectionately."

It might seem that Darwin at times was too skeptical, too hard, and could, on occasion, take a harsh view of human frailties. He certainly made few enough excuses for his own, and as to his attitude in general toward those of his fellow men Hooker has left a line which goes to the very bottom of Darwin's nature: "He would never allow a deprecatory remark to pass unchallenged on the poorest class of scientific workers, provided that their work was honest, and good of its kind." He asked nothing more for himself, and was always as ready to give as to receive. Life was a game to him and he had his rules for playing it. As he said once to a friend, he had no more compunction for being troublesome than a Grand Inquisitor had for torturing a heretic—"for am I not doing a real good public service in screwing crumbs of knowledge out of your wealth of information?"

A young German naturalist had suffered from a flood in Brazil. Darwin promptly "begged" to be allowed to make good his loss—it really would give him pleasure to be allowed to replace his scientific apparatus. And added: "I do not believe that there is anyone in the world who admires your zeal in science and wonderful powers of observation more than I do," which he "ventured" to say as he felt himself a "very old man."

What must have been the feelings of that young

naturalist in Brazil on the receipt of such commendation from the then outstanding figure of the scientific world? A few months later Darwin asked to be "forgiven," "but should you not order through your brother books etc. to the amount of £100, and I would send a check to him as soon as I heard the exact amount. This would be no inconvenience to me; on the contrary, it would be an honour and a lasting pleasure to me to have aided you in your invaluable scientific work to this small and trifling extent."

Imagine what young Bates must have felt when Darwin declared that his paper on mimicry among Amazon insects was "too good to be appreciated by the mob of naturalists without souls; but, rely on it, that it will have *lasting* value, and I cordially congratulate you on your first great work. . . . Wallace will fully appreciate it. How gets on your book? Keep your spirits up. A book is no light labour."

Bates kept his spirits up, and wrote a classic. How much of his work was inspired by that letter, or how far was that "paper" itself inspired by Darwin's having hoped in the previous year that he would not be thought "presumptuous" in saying how much he had been struck by Bates's "varied knowledge and the decisive manner" in which he brought it to bear on each point—"a rare and most high quality"? If the "mob of naturalists without souls" could not appreciate Bates, at least he did, and Wallace would.

John Scott, an employee in the Botanic Gardens

at Edinburgh, wrote Darwin about some of his experiments suggested by Darwin's works. His letters showed "remarkable talent, astonishing perseverance, much modesty, and what I admire, determined difference from me on many points." So Darwin devoted time and thought to his encouragement. Scott wrote a paper for the Linnæan Society: "I should be proud to be the author of it," Darwin wrote him. He bought this "most laborious and able man, with the manners almost of a gentleman," a ticket to India, and otherwise helped him, and when Scott wanted to repay him he was asked "please to recall" that that was not a loan but a gift; there was nothing discreditable in receiving a gift from a rich man; and he was earnestly begged to banish the subject from his mind and begin laying up something for himself in the future. "I really cannot break my word and accept payment. Pray do not rob me of my small share in the credit of aiding to put the right man in the right place. . . . Let us never mention the subject again."

What Darwin liked he liked, and what he believed in he believed in and was willing to back, man or fact, with time or money. It was claimed that glaciers had been discovered on certain mountains in South America: if that were a fact it would be of enormous importance and ought to be looked into. So Darwin wrote Lyell to put him down for fifty pounds to aid the traveling expenses of anyone who wanted to go down there and look into it.

But I am unable to find his answer to the appeal

of a German homeopathic doctor who had become an ardent admirer of the *Origin of Species*. He wrote Darwin that he himself had published about the same sort of a book but had gone "much deeper"; but his explanation of origins was on "the principles of homeopathy or by the law of spirituality." The book had fallen flat in Germany; would Darwin "therefore translate it and publish it in England?"

On a shelf before me is a book of 1200-odd pages on *The Cell*, known to-day in every classroom in the biologic world. The author of that book in 1881 was an unknown assistant in biology in Johns Hopkins University. To him came a letter written by Darwin four months before Darwin's death, thanking him "for having taken so much trouble in describing fully your interesting and curious case of mimickry. . . . I am glad that you intend to make further observations on this mollusc, and I hope that you will give a figure and if possible a coloured figure. With all good wishes from an old brother naturalist." What that must have meant to the young "brother naturalist" can easily be guessed. Professor Wilson himself has recorded that the principal interest of Darwin's letter was the evidence it gave of his extraordinary kindness and friendliness to an obscure youngster without claim upon his time or attention. The incident "made an indelible impression upon my memory and taught me a lesson that was worth learning."

If these bits from Darwin's letters demonstrate that he was the friend of all the world but fail to

bring out the courageousness of a spirit that could rise above the dark shadows of pain and discomfort, and still preserve a sense of humor, a breadth of view, an open mind, and an indefatigable courage, the chapter will have failed in an essential respect.

Darwin had courage. He was not afraid. It is the business of fear to induce flight and subjection. Darwin loved the world of Nature. It is love that makes the wheels go round in the world of living things; love for that world enabled Darwin to encompass it. Having no fear of Nature, he could look at her with understanding eyes. He took the super out of supernatural and it became natural again. He rescued Nature from the shrine of the priest and delivered her into human hands.

CHAPTER IX

MEANWHILE HE HAD BEEN LOOKING AT NATURE

At last gleams of light have come, and I am almost convinced (quite contrary to the opinion I started with) that species are not (it is like confessing a murder) immutable.

DARWIN TO HOOKER, 1844.

GEOLGY is the science of the earth and biology is the science of living beings. When Charles Darwin was a student at Cambridge University, all that was known about the earth and living beings had to be squared with the first chapter of the Book of Genesis. According to that chapter, earth and living beings were hand-created and the hand was God's. Anyone who maintained otherwise was a visionary or a crank, an ignorant quack or a designing atheist. Any textbook of geology or biology then in use in Cambridge would have been good enough for Dayton, Tennessee, in 1925. In fact, up to 1859 the civilized world, with but a half-dozen exceptions, was more solid than is Tennessee to-day; it believed in supernatural creation, Adam and Eve, the Flood, Noah's Ark, and more floods. Geology was a record of floods, cataclysms; biology was a record of species immutably created.

As the geologists could not square all they found with one flood, they created as many floods as they

needed. The Flood of Genesis was regarded as simply the last of a series of destructive cataclysms. Catastrophism, hence, was orthodox; any counter idea was irreligious and damnable.

Sedgwick himself at Cambridge utterly opposed the idea of the slow development of continents, etc., and eloquently defended the idea that the world after each cataclysm had been restocked with a fresh crop of plants and animals, to be in turn destroyed and entombed in the earth's crust at the next cataclysm. Cuvier, the great French naturalist, especially had worked out the doctrine of successive cataclysms. This belief could easily become orthodox because it seemed to afford a scientific basis for the Mosaic account of the Flood and of creation in general. Buckland at Oxford had successfully maintained the doctrine that no geology should be taught which in any way denied the literal interpretation of the early chapters of Genesis.

While Lyell began as a catastrophist, he was an honest geologist, and his *Principles of Geology* marked a huge advance in method. He found more than he could swallow, and by the time his two octavo volumes were ready for the press he had definitely parted company, so far as the history of the earth itself was concerned, with the Mosaic tradition. He had become a *uniformitarian*—uniformity of geologic processes, rather than cataclysms, had brought the earth to its present condition; the past could only be inferred from the present. But he did not put into his two volumes all his facts or all his deductions: he

knew that it was too strong meat for the time—one would believe him.

Possibly, without Lyell's *Principles of Geology*, Darwin would not have written his *Origin of Species*. The first volume inspired him with a passion for geological research. He carried it with him on the *Beagle*, given to him by Henslow with the warning "on no account to accept the views therein advocated." But accept them he did, and believing that the principle of uniformitarianism prevailed in shaping the earth's surface as opposed to the doctrine of cataclysm, he was more or less inevitably led to believe that the cataclysmic doctrine could not apply to the world of living things. To put it another way, if the *extermination* of a species is no more catastrophic than the death of an individual, why should the *birth* of a species be any more a special act of creation than the birth of an individual? And if the first volume of Lyell inspired his geologic interest, the second volume must be regarded as one of the determining causes in directing Darwin's attention to evolution. It was not so much that Lyell gave Darwin a foundation on which he could build: rather that he had stimulated Darwin's zeal and to that extent had opened his eyes wider.

When Darwin set sail on the *Beagle* he was an orthodox catastrophist, and in referring to new species could only speak in orthodox terms. Thus in the original manuscript of his *Journal*, in commenting on finding beds of seashells at a height of 1,300 feet, he said: "It seems not a very improbable con-

jecture that the want of animals may have been owing to none having been created since this country was raised from the sea." But when the *Journal* was printed three years later, that line was dropped, though even in the printed *Journal* occurs such a passage as this: "When finding any animal which seems to play so insignificant a part in the great scheme of Nature, one is apt to wonder why a distinct species should have been created."

Between the writing of the *Journal*, then, and its first publication, Darwin had already begun to be more critical in his attitude toward species. The second edition is even more critical, more evolutionary; in fact, the turning point seems to have come between the first and second editions of the *Journal*. He had read Malthus.

Much has been made of the part played by Malthus in Darwin's development of his theories. The fact seems to be that he had already hit on the principle back of Malthus without realizing it. The most that can be said, I think, is that Malthus acted as a catalyzer in the digestion of Darwin's thoughts, or possibly, as has been said, served as a spark falling on a long-prepared train of thought. But I infer that even without Malthus Darwin's observations would have crystallized into a theory which could be made to work.

Malthus was a modest clergyman who pondered over the problem of overpopulation. His *Essay on Population*, because of its gloomy revelation of misery, met with a roar of abuse—otherwise possibly

Darwin's curiosity would not have been sufficiently aroused to make him pick it up. The gist of the argument of the *Essay* was to the effect that the population of the earth just naturally increases faster than the food supply, and as a result somebody is going to suffer. That gave Darwin his cue: who were going to be the first sufferers?

And yet, before he had ever read Malthus, he had written in his notebook (1837) a forecast of his entire theory. He argued, in substance, that a certain variety—of the ostrich, for example—may not be well adapted to survive and hence will perish; but another variety, being favorably adapted, would more easily survive. Hence a species dies because it is not adapted to changing circumstances.

Before the *Beagle* voyage was a year old, Darwin had begun to see that the mutability of species was a logical conclusion from Lyell's doctrine, and this marked the commencement, in November, 1832, of that long series of observations and reasonings which culminated in the *Origin of Species*.

Darwin himself has told us the striking factors which during the voyage of the *Beagle* forced him to question his old beliefs in Creation and seek a new law. He was impressed by the close resemblance of the giant fossils of Patagonia to living forms, by the manner in which related animals replaced one another southward on the American continent, and especially by the mainland character of the animals of the Galapagos Islands. How could he account for such facts other than by supposing that species can

become and had been modified? "The subject haunted me." He was especially struck by such "adaptations" as the woodpecker, the tree frog, hooks on seeds, etc.

Hardly had he returned home when he began to collect facts bearing on variation—for he saw that he must account for such adaptations before he could tackle the problem of the origin of species. He collected facts wholesale, by printed inquiries, talks with breeders and gardeners, and by extensive reading. He soon saw that man made a success of breeding useful races of plants and animals by *selection*, but who did the selecting in a state of nature?

Fifteen months after he had opened his first notebook in July, 1837, he read Malthus, and as he was already familiar with the struggle for existence, "it at once struck me that under these circumstances favourable species would tend to be preserved, and unfavourable ones to be destroyed. The result of this would be the formation of new species. Here then I had at last got a theory by which to work; but I was so anxious to avoid prejudice, that I determined not for some time to write even the briefest mention of it."

Malthus may have been the spark, but there could have been no explosion to be heard later around the world if Darwin had not by 1838 become a keg of gunpowder. It must not be forgotten that he had been filling that barrel with facts for more than a year, and that the great facts, "the origin of all my views," were the character of the Patagonian fossils

and the species of animals on the Galapagos Islands. That there was much in the barrel at that time we may infer from the fact that Darwin himself, when he looked at the list of books read and abstracted, including whole series of journals and transactions, was "surprised" at his own industry. That barrel before Malthus came along was crammed full of facts which forced the conclusion that selection was the principle of change in domesticated plants and animals; and then, as Darwin wrote more than twenty years later to Wallace, on reading Malthus he saw at once how to apply this principle—Nature herself was the great breeder, the selector, Natural Selection. But, he adds, it was especially the case of the Galapagos Islands which led him to the subject at all.

"My first notebook was opened in July, 1837." The dynamite in that barrel which was to wreck so many superstitions was Darwin's conviction that, if *species* were mutable, Man himself must come under the same law. But as we shall see, Darwin knew the damage that would follow from the broadcasting of that conviction, and as Lyell had deemed it wise to proceed warily in presenting some of his evidence, Darwin was to withhold all his evidence from the public for twenty-two years, and his specific evidence regarding Man's evolution for thirty-four years.

Within a year his first notebook had become "notebook after notebook"—"filled with facts which begin to group themselves clearly under sub-laws." These notebooks were soon replaced by a series of portfolios in which extracts from various works read,

facts obtained by correspondence, records of experiments and observations, and ideas suggested by constant meditation, accumulated for more than twenty years.

The opening of the first notebook marks the beginning of Darwin's definite and irrevocable break with the old dispensation. With his formulation of the theory of natural selection in the following year, he had found the formula by which he could take species out of the realm of magic and evolve them himself. But he was to wait nearly four years more before "I allowed myself to speculate on the subject and drew up some short notes"—called a "brief abstract" in another place.

This "abstract" or sketch of thirty-five pages, written in June, 1842, was for many years supposed to be lost, and was not found until 1896, when Down House was vacated by the Darwin family on the death of Mrs. Darwin; it then turned up in a stair cupboard which was used as a sort of catch-all for papers of no particular value but which Darwin did not wish to destroy. It has been carefully edited and reproduced in as nearly its original form as possible, by Sir Francis Darwin.

The sketch, according to the son, was rapidly written in the old-fashioned elliptical style, on bad paper, with a soft pencil. Much of it was extremely difficult to read; many of the words ended in mere scrawls, and without adequate context were illegible. The articles were omitted, and the sentences loosely composed and even illogical; but, as Francis says,

the whole was "more like a hasty memorandum of what was clear to himself, than material for the convincing of others." And that was all Darwin meant it to be: a "satisfaction" which he had "allowed" himself.

Early summer of 1844 is the third milestone in the actual preparation of Darwin's *Origin of Species through Natural Selection*. He rewrote his abstract of 1842, expanding it into a manuscript of 231 pages, with blank leaves for amplification. After it was written out he revised and corrected it, and penciled certain criticisms in the margin. It was in two parts: "I. 'On the variation of Organic Beings under Domestication and in their Natural State.' II. 'On the Evidence favourable and opposed to the view that Species are naturally formed races descended from common Stocks.'" In the 14,000 words of this remarkable manuscript is a full outline of all Darwin's future work. In one sense it may be said that the remainder of his life was spent in amplifying, tightening, and documenting that outline. But it was Part I of the sketch that contained the main argument which was to appear in the first of Darwin's books on evolution, the *Origin of Species*, to see the light of day seventeen years later.

Perhaps even Darwin himself did not recognize the astounding results that would follow from the publication of that sketch or the finished work he proposed to make it. His modesty would hardly allow him to extend his imagination so far, but that the sketch did mark a "step" he knew full well, as

did he also that it was such a step as the human race should have the opportunity to try out in its march toward freedom. And so his first move was to make arrangements for the preservation of the sketch in case he died before it was published. This he did in a long letter to his wife dated July 5, 1844:

"I have just finished my sketch of my species theory. If, as I believe, my theory in time be accepted even by one competent judge, it will be a considerable step in science. I therefore write this in case of my sudden death, as my most solemn and last request, which I am sure you will consider the same as if legally entered in my will, that you will devote £400 to its publication, and further, will yourself, or through Hensleigh (Wedgwood) take trouble in promoting it . . ."—the idea here being, as he explains, that the sketch should be given to some competent person, together with all books, etc., which would be of value in editing the manuscript. He also requests that Mrs. Darwin herself, or some amanuensis, lend aid in deciphering any of the scraps or notes which the editor may think of use. He thinks Lyell, because he is both geologist and naturalist, would be the best editor if he would undertake it. Next would be Forbes. But Henslow would be "quite best" in many respects, and Hooker would be "*very* good." And if £400 will not get a good editor, Mrs. Darwin is earnestly requested to make it 500. But if Mrs. Darwin, after consultation with Lyell or some other capable man, cannot find an editor who will do this work, "let my sketch

be published as it is, stating that it was done several years ago ["several years ago and" added at a later date] and from memory without consulting any works, and with no intention of publication in its present form."

Apparently, ten years later Darwin still thought it possible that his Sketch of 1844 might have to appear posthumously, for on the back of his letter to Mrs. Darwin he wrote: "Hooker by far the best man to edit my species volume."

While the Sketch of 1844 is an expansion of that of 1842, it is interesting to note that across the table of contents of the 1844 manuscript Darwin wrote: "This was sketched in 1839."

In order to get a better perspective of the events leading up to the climax of Darwin's scientific career, and especially with a view to trying to understand why that climax was so long delayed, it seems advisable to isolate certain facts that have already been noticed so that they may be brought into stronger relief and their significance more fully understood.

When Darwin settled in London in March, 1837, after his short visit home and in Cambridge, he was twenty-eight years old. It was in July of that year that, as he himself said, he opened his first notebook for facts in relation to the origin of species, about which he had long reflected. How long? That we do not know, but we can be fairly certain that when he sailed on the *Beagle* his answer to the question of the origin of species would have been the same as

that of a child of eight when asked who made him—God. That, at that time, was the common belief of the world; species were immutable—they had been *created*, as though by a magician. Those five years on the *Beagle* must have seemed “long.” Presumably serious reflection had begun with the finding of the fossil bones of extinct gigantic monsters in Patagonia.

That same year (1837) he read the last proofs of the *Journal*; the following year he read Malthus and saw much of Lyell; and in 1839, at the age of thirty, he “clearly conceived,” as he put it, the theory (of natural selection). And let it be recalled again that these two years Darwin himself characterized as the “most active” he had ever spent.

Why didn’t he rush into print then and there with his theory? Or rather, why was he to work on it unceasingly for the next twenty years? We shall have light on this question in a moment. The point worthy of emphasis now is that Darwin at the age of thirty was himself entirely convinced that whatever species are or were, the answer to their origin was not to be found in the Book of Genesis but by looking at species themselves—in other words, in the Book of Nature. And that book he continued to study unceasingly.

The next point to be emphasized is that his theory was so clearly conceived when he was thirty-three that he prepared a sketch of it which, had he died then and there, and had it been published even in the rough and imperfect form in which he prepared

it, must have caused men to begin to look at Nature as he had already looked at her—for, be it understood, that rough sketch was a more scientific presentation of the hypothesis of evolution than had ever been formulated by anyone, Greek or Roman, German, French, or English, up to that time; and that two years later, in 1844, when Darwin was thirty-five years old, that sketch had been expanded into a manuscript of 231 pages which contained the kernel and much of the argument of the hypothesis of evolution. And human nature being what it is, again we have to ask why he did not go to print; why wait? Why wait, in fact, until he was actually forced to show his hand?

We can say in general that he waited until he had so prepared his hand that it could be shown with absolute conviction, his idea being, apparently, to make it as fool-proof as possible. He had to prove his case, document it, make it airtight and waterproof. He was dealing with the most momentous question that had ever intrigued human interest—for after all, if “species” were not “created,” neither were men, and the origin of Man was the biggest question men would ever have to face.

All this Darwin seemed to realize, as appears in what follows from a letter to Hooker written early in 1844, one of the most quoted, and often most misunderstood in my opinion, of all the letters Darwin wrote. After asking Hooker a few specific questions on points about which he wanted light, he continued:

I have read heaps of agricultural and horticultural books, and have never ceased collecting facts. At last gleams of light have come, and I am almost convinced (quite contrary to the opinion I started with) that species are not (it is like confessing a murder) immutable. Heaven forbid me from Lamarck nonsense of a "tendency to progression," "adaptations from the slow willing of animals," etc.! But the conclusions I am led to are not widely different from his; though the means of change are wholly so. I think I have found out (here's presumption!) the simple way by which species become exquisitely adapted to various ends. You will now groan, and think to yourself, "on what a man have I been wasting my time and writing to." I should, five years ago, have thought so.

There are three outstanding points in this letter. He is trying out his theory on a friend, and tries it out cautiously, and so says "almost," whereas we may assume there was no "almost" about his conviction.

The second point is even more interesting, and presumably furnishes the reason for his cautious opening. To confess that species were not immutable was like "confessing a murder"—in other words, Darwin knew, as few seem ever to have known, the hold that beliefs with a religious sanction have on men. Men at that time had no answer to the question who made them except the one they had learned at their mother's knee—God. To tell them that they had descended from apes and monkeys was to destroy their most cherished and naïve belief. More than that, to strip human beings of their supernatural and divine origin was to strip Man himself of his taint of original sin due to the Fall caused by the

Serpent, and, as Gladstone put it, was to relieve God of the labor of creation and discharge Him from governing the world. And that is what Darwin's theory proposed to do. He felt like a murderer.

He knew, and knew only too well, how the entire so-called civilized world had organized itself to meet the issue of the curse of original sin, for there were those, as we have seen, who held that without original sin there could be no promise of redemption and eternal salvation. It was not mere men that Darwin was "murdering" but their immortal souls! This is the man, it will be recalled, who as a medical student fled from the operating room because he could not bear to see a child in agony, and who so loved his pigeons that he could not bear to kill them that he might study the variations in their skeletons.

The third point is the attitude displayed toward Lamarck, from whose nonsense Darwin asked to be forfended. What nonsense? "Tendency to progression," "adaptations from the slow willing of animals," etc. Darwin himself said that Lamarck's conclusions were not widely different from his own; in other words, he admitted that Lamarck was an evolutionist. He objected, and properly, to the idea that species had evolved through their slow *willing* or because of a "tendency" to progress. We have already seen that Darwin had reason as a youngster to be prejudiced against Lamarck for putting forth theories similar to those of his grandfather Erasmus, and we have reason to believe that he had long been acquainted with Lamarck's views. That either

Erasmus or Lamarck was a real factor in bringing about his own change of mind, or in suggesting his own theory, we have no evidence. How Darwin came later to look with favor on the so-called Lamarckian factors in evolution we shall see.

And so, when we find Darwin as early as 1844 convinced as to the truth of evolution and in possession of a hypothesis to account for it, we find him holding back because he did not want to be a "murderer" on the one hand, and on the other because he had a thousand and one questions he wanted to ask of himself, of his friends, and of Nature herself, before he would feel prepared to defend his thesis to the world.

Meanwhile, he had innumerable irons in the fire, and, more specifically, in preparation for the press, either as author or editor, many volumes growing out of investigations begun on the *Beagle*. And so for the next twelve years, from 1844 to 1856, he was working on specific problems—but never allowing his interest in his great work to relax and always looking forward to it. Thus he closed a letter to Hooker in 1845 with the hope that next summer he would finish a work on geology, then do a little zoology, and "Hurrah for my species work!" In that same year to another friend he spoke of steadily reading and collecting facts on the question of species and of having been "driven" to a certain conclusion for which he knows he will lay himself open to reproach, but "I have at least honestly and deliberately come to it. I shall not publish on this subject for several

years." In a letter to Hooker in 1853 he said he had felt humiliated that his only doubt was whether the form "varied *to-day or yesterday*, not to put too fine a point on it, as Snagsby would say."

The "little zoology" that Darwin spoke of in 1845 was to become his chief occupation in 1846 and hold him for eight years on his monumental work on barnacles. That he had no idea he would put so much time into this work we infer from a line in a letter written in 1846, in which he speaks of beginning soon to look over his ten-year-long accumulation of notes on species. He predicts in that letter that to write out his notes would take five years—and then when published? Did anybody inside or outside the world of science in 1846 believe in evolution? They not only did not believe in evolution, but Darwin expressed the opinion in that letter that the publication of his views would cause him to "stand infinitely low in the opinion of all sound naturalists"!

Practically nothing more is heard of his species work from 1846 to 1856, but we know that at the end of 1853 one part of his barnacle work was finished and in 1854 he prepared a second part; and that by September, 1854, he had, as it were, cleared his decks for action. Thereafter, in his own words, he spent his whole time in arranging his huge pile of notes and in observing and experimenting regarding the problem of the transmutation of species.

The year 1856 is another milestone in the *Origin of Species*. So crowded was that year with experiments, with letters to friends, and with the manipulation of

his ideas, that near its end he wrote his cousin: "Sometimes I fear I shall break down, for my subject gets bigger and bigger with each month's work." This was after he had actually been getting things down in black and white.

Lyell had again and again warned him that he must get his hypothesis in print, or run the risk of being forestalled. His brother Erasmus likewise had warned him: "You will find that someone will have been before you." Driven by these repeated warnings and urgings, Darwin, in May of 1856, actually commenced writing his book. He kept steadily at it until a fateful day to come two years later, by which time he had written ten chapters—about half the projected book.

Apparently Lyell had urged him to prepare first a paper for some scientific publication, but Darwin saw what that might lead to, and did not at all like the idea of getting some society in trouble for publishing such revolutionary ideas. His entire reaction was quite characteristic of the man. See how he states his case in a letter to Hooker: "I am fixed against any periodical or Journal, as I positively will *not* expose myself to an Editor or a Council, allowing a publication for which they might be abused. If I publish anything it must be a *very thin* and little volume, giving a sketch of my views and difficulties; but it is really dreadfully unphilosophical to give a *résumé*, without exact references, of an unpublished work. But Lyell seemed to think I might do this, at the suggestion of friends, and on the ground, which

I might state, that I had been at work for eighteen years, and yet could not publish for several years."

He returns to the idea in another letter, telling Hooker that he cannot bear the idea of *begging* some editor and council to publish, and then perhaps have to apologize for having got them in a scrape. The upshot of which was that Darwin began to prepare a volume and not a paper.

Did Lyell or Hooker believe in Darwin's theory in 1856? There is not a particle of evidence that either had yet swung around to that belief. Hooker, to get around botanical difficulties, felt at liberty, as Darwin put it, to "make continents as easily as a cook does pancakes." Darwin himself was decided on the question of the origin of species; "but, good heavens, how little that is worth!" In other words, Hooker was no more ready to swallow his views than Darwin was to gulp down Hooker's continents.

A line in another letter that year illumines the state of mind in general about the immutability of species. After saying that he himself had hardly a vestige of belief in the permanence of species, he added: the "confession will make you think very lightly of me." In other words, the naturalists of the time not only believed in the permanence or immutability of species, but the belief was so set that they would regard as a crank the man who held otherwise. So keen was Darwin in looking for an opening in what seemed a perfectly blank horizon that he was "delighted" that Lyell would even allow him to say that his forthcoming "essay" was published at Lyell's

suggestion. That did not mean that Lyell believed in it or approved of it, but it did mean that he was so impressed by it that he thought it ought to be published. Darwin's delight was that a man of the public standing of Lyell in the scientific world had even suggested its publication.

Not the least important of the letters Darwin wrote that year was one to his American friend Asa Gray, in which for the first time he let this great botanist into his secret. Only Darwin's own words will help us to see how tenderly he approached the subject and how little he hoped to win Gray over: ". . . For to my mind to say that species were created so and so is no scientific explanation, only a reverent way of saying it is so and so. But it is nonsensical trying to show you how I proceed in the compass of a note. But as an honest man, I must tell you that I have come to the heterodox conclusion that there are no such things as independently created species—that species are only strongly defined varieties. I know that this will make you despise me."

It may here be noted that Darwin himself throughout the preparation of his *Origin of Species* was always on the lookout for possible counter arguments, always trying to anticipate reasonable objection. One sentence in a letter to Hooker that year (1856) illustrates this point: "I know in my own case my most frequent source of doubt was whether others would not think this or that was a God-created Barnacle, and surely deserved a name." In other words, while he was examining ten thousand-odd barnacles and

trying to establish their relationships and arrange them in species, etc., he was always trying to decide whether he had shown the relationships so clearly that "others" would not think, while there might be close relationships among certain species, certain ones of them were God-created and therefore immutable.

The outstanding event of the following year (1857) was Darwin's taking Gray more completely into his confidence—Gray having shown a readiness to listen to his "heterodox conclusion." That meant much to Darwin, and led him to confess to Gray that he "did not feel in the least sure that when you knew whither I was tending, you might not think me so wild and foolish in my views (God knows, arrived at slowly enough, and I hope conscientiously), that you would think me worth no more notice or assistance."

In that letter Darwin enclosed a brief abstract of what he called his "notions on the means by which Nature makes her species," which "notions" were founded on facts "in the affinities, embryology, rudimentary organs, geological history, and geographical distribution of organic beings"; but Gray was to take his abstract "immensely on trust," for each paragraph occupied one or two chapters in his book, and he was not to mention Darwin's doctrine. This letter to Gray and its enclosed "abstract" of Darwin's "notions" will be heard from again.

Wallace, working in the Dutch East Indies, had aroused Darwin's interest by a paper in the *Annals of Natural History* in 1855, and he had entered into

correspondence with him. From that paper and from their correspondence it was plain to Darwin that he and Wallace had come to certain similar conclusions. Possibly Wallace's paper ("On the law that has regulated the introduction of new species") had been the deciding factor in Darwin's acceptance of the advice of his brother and of Lyell that he begin to prepare for publication; at any rate, a letter from Darwin to Wallace dated May 1, 1857, in reply to one of October 10th of the previous year from Celebes, records the fact that he and Wallace "have thought much alike, and to a certain extent have come to similar conclusions."

He then tells Wallace how, twenty years after he had opened his first notebook "on the question how and in what way do species and varieties differ from each other," he was at last preparing his work for publication; it was a big subject, and though he had written many chapters he probably would not go to press for two years. In other words, Wallace was no creationist (he did not have to order a Deluge to account for a new species); and Darwin, therefore, was the more ready to show a bit of his hand, though only a bit, for it was "really *impossible*" in a letter to explain his views on the causes of variation in a state of nature; "but I have slowly adopted a distinct and tangible idea,—whether true or false others must judge; for the firmest conviction of the truth of a doctrine by its author, seems, alas, not to be the slightest guarantee of truth!"

Wallace, presumably in reply to that letter, had

asked whether Darwin proposed to discuss *Man*. Said Darwin: "I think I shall avoid the whole subject as so surrounded with prejudices; though I fully admit that it is the highest and most interesting problem for the naturalist."

The year 1858 is another milestone in the *Origin of Species*. In many respects Darwin's letter to his friend Lyell on the 18th of June was the hardest one he ever wrote in his life: "Your words," he wrote, "have come true with a vengeance—that I should be forestalled." And it seemed as though he certainly had been. All of his "originality, whatever it may amount to," was about to be smashed, and Darwin himself in that letter was proposing to do the smashing.

What had happened was this: that very morning Darwin had received from Wallace, on the other side of the earth, a paper "On the Tendency of Varieties to depart indefinitely from the Original Type." Darwin, after looking at it, was to forward it to Lyell, and Lyell was to return the manuscript to Darwin. Wallace had not said that Darwin was to publish the paper; apparently all he sought was an opinion on the views therein expressed. But Darwin in his letter to Lyell said without hesitation that he would "of course" offer to send it to any journal.

Did Darwin himself approve of Wallace's sketch? Why shouldn't he? It contained "exactly the same theory as mine," or as he wrote Lyell: "I never saw a more striking coincidence; if Wallace had had my MS. sketch written out in 1842, he could not have

made a better short abstract! Even his terms now stand as heads of my chapters."

Lyell was for Darwin on this occasion what Uncle Jos had been during those fateful September days twenty-seven years before; he had no idea of allowing Darwin thus calmly to efface himself. But what to do? It was a delicate situation and had to be handled not only with tact but with absolute fairness and impartiality to the two men concerned.

Lyell suggested that Darwin publish his own views at once. Darwin took up the matter in a long letter dated June 25th. He admitted there was nothing in Wallace's sketch not more fully written out in his own sketch of 1844; that sketch had been read by Hooker a dozen years ago, and a short abstract of it had been sent to Asa Gray a year ago; and it was true that if he were to publish he would be taking nothing from Wallace. But he could not persuade himself that he could do so honorably.

True, Wallace had said nothing about publication; nor had Darwin himself intended to publish for some time yet; but could he do so now just because Wallace had sent him an outline of his views? "I would far rather burn my whole book, than that he or any other man should think that I had behaved in a paltry spirit."

Darwin really was in a quandary, and he could not "tell whether to publish now would not be base and paltry." That, at any rate, was his first impression, and he would have acted on it if it had not been for Lyell's letter. In further appreciation of the deli-

cacy of the situation he asked Lyell to forward that letter to Hooker and reply through him, "for then I shall have the opinion of my two best and kindest friends." And in a postscript next day he again took up the point whether Wallace might not justly accuse him of having taken advantage of the fact that Wallace had communicated his views. It was hard to be thus compelled to lose his priority of many years' standing, "but I cannot feel at all sure that this alters the justice of the case." He was still inclined to the belief that his first impression was right—that it would be dishonorable of him now to publish.

While the stupendous question is being decided, it will be interesting to see how Wallace came to views so nearly like those of Darwin as to furnish one of the outstanding cases of parallelism of thought in human history.

Wallace, like Darwin, had read and had been impressed by the *Vestiges of Creation*. In 1848 he was a wandering naturalist in Borneo. Alone with his Malay cook-boy, during the evenings and wet days he had nothing to do but look over his books and ponder the problem rarely absent from his thoughts—the distribution of plants and animals. Lyell to him also had been enormously stimulating. Out of all that came his paper already referred to, "On the law that has regulated the introduction of new species," published in the *Annals* in 1855. The main conclusion of that paper, that "every species has come into existence coincident both in time and space with the preexisting

closely allied species," of course clearly pointed toward evolution. Wallace did not call it evolution, nor had he yet formulated any idea as to *how* evolution had come about.

In the spring of 1858, when Wallace lay sick with fever at Ternate in Celebes, he suddenly remembered what he had read in Malthus some twelve years before. Then and there, "in a sudden flash of insight," the idea of natural selection was presented to him. He thought over it for a few hours, wrote down the main points, and within a week copied the matter out on thin letter paper and sent it to Darwin by the next post.

I have no way of learning the date on which Wallace posted that letter, or the date he received Darwin's letter of May 1, 1857, or whether Darwin's letter of December 22, 1857, reached him in time to have prompted that "sudden flash." What is certain is that we have nothing to show that either Wallace or Darwin in their behavior toward each other was ever or for one minute other than an honorable gentleman.

Wallace declared it to be a "singular piece of good luck" that gave him any share in the discovery.

Darwin's attitude was a beautiful example of modesty, unselfish admiration for Wallace's work, and a loyal determination that he should receive full credit for his independent labors.

Lyell and Hooker decided that fairness all round demanded an immediate presentation of Wallace's paper and of Darwin's views to the Linnæan Society.

Owing to the death of the great botanist Robert Brown, ex-president of the Society, a special meeting had been called for July 1st, and at that meeting a joint paper of Darwin and Wallace, entitled "On the Tendency of Species to form Varieties; and on the Perpetuation of Varieties and Species by Natural Means of Selection," was read by the secretary of the Society. Wallace's contribution was his paper as received; Darwin's was made up of extracts from his sketch of 1844 and part of his 1857 letter to Gray—in all a little more than six pages. But in these six pages Darwin described how animals tend toward a geometric rate of increase, the checks that occur, the effects of changed conditions, the natural selection of better equipped forms resulting from the struggle for existence, and the influence of sexual selection.

Lyell and Hooker both said a few words to emphasize the importance of the occasion. No discussion followed, for "the subject was too novel, too ominous, for the old school to enter the lists before armouring." But the interest excited was intense and after the meeting the paper was talked over with bated breath. And why not? It was the most notable event in the annals of biology since the appearance in 1735 of Linnæus's *Systema Naturæ*. Curiously enough, Bentham, the great botanist, had prepared for the meeting a long paper illustrating the *immutability* of species; after hearing the joint communication he omitted from his paper everything relating to original fixity.

Darwin himself could not be present at the meeting. He was very ill, scarlet fever was raging in his family, his two-year-old son Charles had died only the previous day, and one daughter was ill with diphtheria. But distressed as he was he could write to Hooker: "You have acted with more kindness, and so has Lyell, than even I could have expected from you both, most kind as you are. . . . God bless you."

Darwin would have had to be more than human to pass through that month of June without anguish, confronted as he was with the thought of the glory of his great work vanishing into thin air and with the actual disintegration of his family through sickness, but by the 13th of July he could write to Hooker: "I always thought it very possible that I might be forestalled, but I fancied that I had a grand enough soul not to care; but I found myself mistaken and punished; I had, however, quite resigned myself, and had written half a letter to Wallace to give up all priority to him, and should certainly not have changed had it not been for Lyell's and your quite extraordinary kindness."

Presumably Hooker had already become a convert to the mutability of species, for Darwin added: "You cannot imagine how pleased I am that the notion of Natural Selection has acted as a purgative on your bowels of immutability."

There was nothing left for Darwin to do now but to go ahead and prepare for publication; the real problem was how much of the great mass of available

material should be used. On the 20th of July we find him with his family at Sandown on the Isle of Wight. There he began what he intended to call an Abstract of his species book, but he made little headway until he returned to Down House and, as he said in his diary on September 16th, "recommenced" his Abstract. He did not then think it would take him more than four or five months to finish it, but delays due to sickness, etc., caused the work to drag, and more than thirteen months were to pass before it was published.

Early in 1859 the question of publication was settled. Lyell had taken up the matter with the well-known publisher Murray—as Darwin had learned from a letter of Lady Lyell, prompting him to ask: "and is he willing to publish my Abstract? Does he know at all of the subject of the book?" He also asked whether Lyell would advise him to tell Murray that his book was not more unorthodox than the subject made inevitable and that "I do not discuss the origin of man. That I do not bring in any discussion about Genesis, &c., &c., and only give facts, and such conclusions from them as seem to me fair. Or had I better say *nothing* to Murray, and assume that he cannot object to this much unorthodoxy, which in fact is not more than any Geological Treatise which runs slap counter to Genesis."

March finds him making corrections and getting ready for the press. By May the manuscript was practically finished. In September he was begging Lyell to keep his mind open till he received the last

and most important chapters. "I cannot too strongly express my conviction of the general truth of my doctrines, and God knows I have never shirked a difficulty. I am foolishly anxious for your verdict, not that I shall be disappointed if you are not converted."

The title Darwin proposed, *An Abstract of an Essay on the Origin of Species and Varieties through Natural Selection*, seemed cumbersome to Murray, and he especially objected to the term "Abstract," so, as actually published on November 24, 1859, the book bore the title: *The Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life*.

Few things in Darwin's life are finer than his serene confidence in the worth of that little coterie of friends, Lyell, Hooker, Gray, and Huxley; if his arguments could win them to his side he knew that victory must ultimately be his, and he could afford to sit tight until the storm of opposition had passed. He did not have to wait long.

The storm itself, of course, has not passed; those whose innate curiosity to find out the *how* of things has been arrested in infancy by a few formulæ with alleged supernatural sanction, are no readier to-day than they were sixty-five years ago to accept Darwin's answer to the riddle that had intrigued his mother before him and his grandfather Erasmus before her. But if the storm of opposition let loose by the publication of the *Origin of Species* is not yet spent, at least the issue is clear: one may recoil at

CHAPTER X

WHAT HE SAW ASTOUNDED THE WORLD

Oh! my dearly beloved puny child, how cruel men are to you!

DARWIN.

THAT was Darwin's postscript to a letter to Hooker a few weeks after the publication of the *Origin of Species*. Had he the faintest idea that that puny child was to grow into a ruler of human thought?

Few statements have oftener been made about the *Origin of Species* than that it revolutionized thought. It did. But only, then as now, for the seekers of truth. On those already convinced of the divine origin of Man and regarding the Mosaic account of creation as a precious revelation, it had then, as it has now, no effect at all; they cannot see it because they will not look in that direction. They are not curious, for their naïve curiosity about origins, human destiny, etc., has been satisfied with the Old Story. Full to satiety, they have no appetite for anything new. Yet in 1860, as now, thousands of the eager-eyed were ready to consider a new doctrine if it seemed workable, reasonable, logical, sound.

By 1860 Man's tendency to be skeptical, to be receptive to new ideas, had reached a very definite stage; especially were there thousands of naturalists and students of science who, while not in open revolt

against the old doctrine of fixity or intransmutability of species, simply held to that because nothing else had appeared which they could tie to or which offered them a way out. In other words, the world of intelligence in England, in the United States, in Germany, and to a lesser degree in France, was groping in the dark but was ready for light. The publication of the *Origin of Species*, as Huxley so well put it, was such a light, a flash which to a man lost in a dark night suddenly reveals a road which, whether it takes him home or not, certainly goes his way. That was what they had been looking for and could not find; the *Origin* provided them with the working hypothesis they sought.

And probably more than one scientist's reflection agreed with Huxley's when he first made himself master of the central idea of the *Origin*: how extremely stupid not to have thought of that! They could see, as Gladstone and the Church failed to see, that the hypothesis of evolution was neither for nor against God—that, as Huxley said, it had no more to do with theism than had the first book of Euclid. The *Origin of Species* simply furnished a means whereby men could free themselves of the tyranny of the old sham solutions as to origins, etc. But, I repeat, those whose minds were made up were not looking for freedom; they never have been in any age. There are few things harder than the revision of *convictions*, for there are none so blind as those who will not see. Darwin's immediate fate, like that of every apostle of light from Christ onward,

was to be pilloried for blasphemy. With the publication of the *Origin of Species* the storm was let loose.

To describe that storm in detail is not an intrinsic part of the story of the evolution of Charles Darwin, nor possible in the compass of this book, but it is part of our story to set forth briefly how the *Origin* was received and how Darwin himself reacted to that reception.

The full significance of the attacks on Darwin can only be realized when seen against the background of his personality. Darwin was no upstart, no obscure figure, in 1859. His life had been blameless and above reproach, and had been lived in full sight of his fellow men. His *Journal of the Voyage of the Beagle* was widely and favorably known. His published works on geology and zoology were scholarly and known far and wide. In short, it would seem that no man living at that time had a better right to be heard with attention and respect than Darwin; it would seem that no personal character should have been further removed from the range of hate. It would seem, in short, that any view he might express in the *Origin of Species* was entitled to a square deal from the reviewers.

Yet the *Quarterly Review* held him up to scorn as a flighty person who endeavored "to prop up his utterly rotten fabric of guess and speculation," and whose "mode of dealing with Nature" was reprobated as "utterly dishonourable to science." That reviewer, like most of the reviewers of the time, in Huxley's words lacked the will or the wit to master

Darwin's doctrine; they simply did not know enough to follow him—and to cover up their ignorance they fell back on the prejudice of bigotry or substituted railing for reason.

The reviewer who asked if it was "credible that all favourable varieties of turnips are tending to become men," was offering his readers the cheapest and most vulgar form of smartness as a substitute for sober criticism. He was so ignorant of paleontology that he could talk of the *flowers* and *fruits* of Carboniferous plants, and was so incredibly ignorant of physiology that he could ask what advantage of life could alter the shape of the corpuscles into which the blood can be evaporated! That *Quarterly* review was a fair sample of the fate of an epoch-making volume at the hands of the so-called intelligent public of 1860; and that reviewer would probably have been insulted if anyone had questioned his Christianity or his intelligence—or his honor!

The *Athenæum*, in a scathing review, left Darwin "to the mercies of the Divinity Hall, the College, the Lecture-Room, and the Museum." Darwin's comment was that he was "a bit chagrined." To Hooker he wrote: ". . . the manner in which he drags in immortality and sets the priests at me, and leaves me to their mercies, is base. He would, on no account, burn me, but he would get the wood ready and tell the black beasts how to catch me."

Some months later Darwin complained to Gray that he had lately been getting "more kicks than halfpennies." The *Dublin Natural History Review*

was the most unfair of all the reviews that had appeared—"one mass of misrepresentation"; and that review was evidently written by a geologist, chemist, and mathematician! The adverse criticism of the *Origin* in academic circles was especially galling to Darwin. Even the man who had started him out as a geologist, his "poor dear old Sedgwick," wrote him a slashing letter and declared that he had "laughed till his sides ached" at his book.

By the end of May, 1860, as Darwin wrote Hooker, he clearly foresaw that the progress of opinion regarding the book would be excessively slow, "almost as slow as the change of species. . . . I am getting wearied at the storm of hostile reviews, and hardly any useful." And Darwin meant that. He had spent the better part of a lifetime working on that book. Wherein was he wrong? Wherein was his reasoning false? No man was more keen to be set right when he was wrong, no one could keep his mind more open to constructive criticism. He was not getting it, he was deluged with such abuse as only ignorance can prompt.

We know from Darwin's own words that he was acutely sensitive to praise and blame, yet the way he rode out the storm of popular prejudice is one of the finest things in human history. Not a scientific academy or society, not a college or university in the world, came forward to greet him. And yet, provoked as few men have been, there is no sign in his letters or elsewhere of envy, hatred, or malice. He met unfairness and injustice fairly and justly, and

until his death twenty-two years later, any objection, as long as it was reasonable, from the least significant of men, was entertained respectfully and patiently.

It would almost seem as though, without the aid of five men, he might not have outridden the gale. Lyell's *Principles of Geology* had in a sense prepared the way, and Lyell himself soon became a convert to the hypothesis of evolution and was thereafter, in the words of Huxley, "a tower of strength." Hooker and Lubbock (afterward Lord Avebury) were to be found wherever the fight was thickest. But the man who started the fight in England was Huxley, whom Darwin called his "agent general" and who called himself "Darwin's bulldog."

Gray led the fight on the American side, and successfully led it against the great Agassiz himself. He won because he knew what Darwin was driving at—Agassiz did not. Agassiz' attempt in a public lecture to belittle the *Origin* was so bunglingly done that he actually made converts! Agassiz also attacked the *Origin* in *Silliman's Journal*; and the editor promptly wrote Darwin that the *Journal* was open to him for reply. Darwin's reaction to this offer, as seen in a letter to Dana, the great geologist at Yale, was characteristic: "I cannot decide till I see it, but on principle I have resolved to avoid answering anything, as it consumes much time, often temper, and I have had my say in the *Origin*."

Immediately on receipt of the book Gray plunged into it, and wrote in January that he was free to say he had never learned so much from one book as he

had from the *Origin of Species*: "There remain a thousand things I long to say about it."

Darwin comments in a letter to Gray in April upon the fact that the two most striking reviews of his book thus far had both appeared in America. One was in the *New York Times* of March 28, 1860, and the other was written by Gray himself. Gray also prepared three articles, which were printed in the July, August, and October numbers of the *Atlantic Monthly*; these were later reprinted in pamphlet form. How well Gray understood Darwin's views we infer from Darwin's letter: "You never touch the subject without making it clearer. I look at it as even more extraordinary that you never say a word or use an epithet which does not fully express my meaning."

One of the letters that must have pleased Darwin greatly was from his curious brother Erasmus: "For myself I really think it is the most interesting book I ever read, and can only compare it to the first knowledge of chemistry, getting into a new world or rather behind the scenes. . . . My ague has left me in such a state of torpidity that I wish I had gone through the process of natural selection."

One of the earliest copies of the *Origin* was sent to Huxley, who replied (November 23, 1859): "I finished your book yesterday. . . . As to the curs which will bark and yelp, you must recollect that some of your friends, at any rate, are endowed with an amount of combativeness which (though you have often and justly rebuked it) may stand you in good

stead. I am sharpening up my claws and beak in readiness."

The idea of that self-styled "bulldog" "sharpening his beak" is good; but, at any rate, Huxley was ready for the great fight soon to come.

The story of the set-to between Huxley and the Bishop of Oxford is a classic. And, like other classics, there are two versions: in the excitement of the moment no one had the foresight to set down just what the two men did say. But as to who won the bout there is entire agreement.

The 1860 meeting of the British Association for the Advancement of Science was held at Oxford. It was inevitable that Darwinism should somewhere, somehow, get into the proceedings. It did; and led to two pitched battles.

On June 28th, a paper "On the final causes of the sexuality of plants, with particular reference to Mr. Darwin's work on the Origin of Species," was read. Huxley was invited to discuss it, but, apparently finding nothing to set his teeth in, he merely stated that a general audience in which sentiment might interfere with intellect was not the public to hear such a discussion. Sir Richard Owen, then the greatest anatomist in England and a commanding figure in the scientific world—but so jealous of his own views that he could see no other—found the opening to his liking, and expressed his "conviction that there were facts by which the public could come to some conclusion with regard to the probabilities of the truth of Mr. Darwin's theory." He then went

on to make the astounding assertion that there was more difference between the brains of gorillas and men than between the brains of gorillas and the very lowest monkeys. Huxley could not let that statement go unchallenged—for two years he had been investigating that very point—and replied with a direct and flat contradiction, pledging himself to justify that unusual procedure elsewhere—a pledge fulfilled in his *Man's Place in Nature*.

On the second day after this preliminary skirmish came the real fight, precipitated this time by a paper entitled "The Intellectual Development of Europe, considered with reference to the views of Mr. Darwin," and offered by Draper of New York, author of the well-known *History of the Intellectual Development of Europe*.

The word "Darwin" alone in the announced title would have filled the lecture hall, but it was also known that Wilberforce, the Bishop of Oxford, would discuss the paper; and the meeting was adjourned to a larger hall holding about 800 people. That hall was crammed to suffocation long before the meeting was called to order, even the windows being packed with ladies. Had this meeting been held during term time, and had the general public been admitted, the news that a Darwinian paper was to be discussed by the Bishop would have filled the largest hall in England.

Curiously enough, the president of the section in which the paper was read was the man Darwin used to walk with, Professor Henslow. He wisely an-

nounced that no one could discuss the paper without having a valid argument to present on one side or the other.

On the platform with Henslow were Draper, the Bishop, Hooker, and Sir John Lubbock. In the middle of the hall was a mass of clergy, and in one corner of the room a knot of undergraduates.

Draper droned along for more than an hour, turning first to the right and then to the left, and finally bringing in a reference to the *Origin of Species*. That set the ball rolling. The first speaker emitted much theologic venom in a big voice; the next speaker, some theologic venom in a thin voice, and was promptly shouted down. The third speaker, a Mr. Dingle, advanced the idea that Darwin would have made a better job of his *Origin* if he had consulted him, then turned to the blackboard and began to demonstrate: "Let this point A be man, and let that point B be the mawnkey"—and was shouted down with cries of "Mawnkey!" The next speaker admitted that he did not know enough about the theory to discuss it adequately, but thought it should be discussed fairly. That was the Bishop's cue.

The Bishop spoke for half an hour with "indomitable spirit, emptiness, and unfairness." From the start it was evident that his knowledge of the *Origin* was second-hand and that his guns had been loaded with ammunition taken from Owen's review in the *Quarterly*. Owen himself, it was learned later, had crammed the Bishop for this particular occasion.

He ridiculed Darwin and rended Huxley; and in

persuasive manner, light and scoffing dulcet tone, and fluent, florid, well-turned periods, assured his audience that there was nothing in the idea of evolution. And he might have won the fight if he had not become captivated by his own eloquence and descended to cheap personality. Turning to Huxley with an insolent smile, he begged to know "was it through his grandfather or his grandmother that he claimed his descent from a monkey?"

Huxley slapped Sir Benjamin Brodie on the knee and exclaimed: "The Lord hath delivered him into mine hands!" And so indeed he had. Whether or not the Bishop's remark was really as insolent, vulgar, and personal as has been reported, it was flippant and unscientific, and unhappy in its attempt to arouse sympathy by reference to woman. All of which Huxley grasped in a moment.

Tall and slight, stern and pale, quiet and grave, Huxley slowly and deliberately rose and delivered the blow heard around the world. The excitement was great. The undergraduates in the corner, realizing where Huxley's words were leading, gave vent to a shout of applause which fairly drowned his voice; hence the discrepancy as to the exact words Huxley used.

The best-known version is that of John Richard Green, then an undergraduate and later to become famous for his *History of the English People*, told to his friend Boyd Dawkins (to become equally famous as the author of *Cave Hunting*). According to Green, Huxley asserted that a man had no reason to be

ashamed of having an ape for a grandfather, but "if there were an ancestor whom I should feel shame in recalling, it would be a *man*, a man of restless and versatile intellect, who, not content with success in his own sphere of activity, plunges into scientific questions with which he has no real acquaintance, only to obscure them by an aimless rhetoric, and distract the attention of his hearers from the real point at issue by eloquent digressions and skilled appeals to religious prejudice."

Green continued: "The excitement was now at its height; a lady fainted and had to be carried out, and it was some time before the discussion was resumed." But there is no record that the ladies in the windows waved their handkerchiefs at Huxley as they had at the Bishop.

Order was finally restored and there were calls for Hooker. Whereupon Hooker demonstrated "that the Bishop, by his own showing, had never grasped the principles of the *Origin*, and that he was absolutely ignorant of the elements of botanical science." To which the Bishop made no reply.

But the full significance of Huxley's victory cannot be had without realizing that the Bishop had been a high honor man at Oxford and was regarded by the university as an authority on all branches of natural history. He had been chosen to uphold orthodoxy, to kill with sarcasm and ridicule the new, dangerous, and unorthodox notion of evolution. The university was behind him!

That night, at a crowded *conversazione* in the rooms of one of the professors, Darwin was the topic of discussion, and Hooker and Huxley were congratulated as the winners in the combat, Huxley especially being eagerly congratulated as the hero of the day. One simple-minded person expressed the wish that the engagement could be repeated, but Huxley, "with the look on his face of the victor who feels the cost of victory," replied: "Once in a lifetime is enough, if not too much." Huxley could not forget that he himself had been a fundamentalist and as a child had been warned as to what happens to unbelievers. To make a fool of a Bishop in a crowded house once was enough for a lifetime.

Curiously enough, Darwin's old shipmate Fitz-Roy, captain of the *Beagle*, was present, and in a state of frantic excitement kept brandishing a Bible and making impassioned appeals to the authority of the "Book." He recalled later that he had often expostulated with his old comrade of the *Beagle* for entertaining views which were contrary to the First Chapter of Genesis.

Even more curious is the fact that Huxley himself was there by the merest chance—as he wrote Francis Darwin thirty years later. He had heard that the Bishop was to speak and knew his reputation as a fighter; he also knew that the audience was sure to be strongly pro-Bishop. Besides, he was tired and wanted to spend the week-end with his brother-in-law at Reading. Hence his chance remark to Robert

Chambers the day before the combat that he could see no good in giving up his peace to be episcopally pounded; whereupon Chambers called him a deserter. Huxley took the dare and declared: "I will come and have my share of what is going on."

Apparently Huxley did not look forward to the meeting with great relish, but when he realized the depths of the Bishop's ignorance his "spirits rose proportionately, and when he turned to me with his insolent question"—that was when he remarked to Sir Benjamin: "The Lord hath delivered him into mine hands!"

And "that sagacious old gentleman," said Huxley, "stared at me as if I had lost my senses. But in fact the Bishop had justified the severest retort I could devise, and I made up my mind to let him have it." Cunning Huxley! He was careful, he admits, not to rise to reply until the meeting called for him—"then I let myself go."

The news of the big fight soon got to Darwin, who, because of illness, could not attend the Oxford meeting. To Hooker he wrote of his astonishment at his success and audacity and saying he had no idea he had such power; his "kindness and affection brought tears into my eyes." To Huxley he wrote of having learned of the "awful battles" which had raged about species at Oxford, and after referring to Huxley's noble fight with Owen and his capital answer to the Bishop, added: "I honour your pluck; I would as soon have died as tried to answer the Bishop in such an assembly." From which we may

infer that Darwin himself had not entirely forgotten that Bishops are Bishops and unanswerable. But Huxley had answered one bishop, and that answer had given enormous impetus to the interest in the *Origin of Species*. The unsuspecting Bishop had not bestowed his blessing on the "puny child," but he had given it gratis the kind of advertising that neither money nor publisher could have bought.

Thereafter the "puny child" walked alone, followed by an ever-increasing army of friends and admirers until in one form or another it had entered every home in the civilized world: for, with Huxley, one cannot doubt that no single book except Newton's *Principia* "ever worked so great and so rapid a revolution in science, or made so deep an impression on the general mind."

Of the many letters Darwin received after the publication of the *Origin*, two are so curious as to deserve honorable mention. The first was from a Frenchman, who wrote that he had become a convert to the doctrine of evolution because Darwin had made the Birth of Christ, Redemption by Grace, etc., plain to him! Even more curious was the letter from a learned Jew about his book, *Toledoth Adam*, written with the object of convincing his co-religionists of the truth of the theory of evolution:

To the Lord, the Prince, who "stands for an ensign of the people" (Isa. xi. 10), the Investigator of the generation, the "bright son of the morning" (Isa. xiv. 12), Charles Darwin, may he live long! . . . "The vision of all this" (Isa. xxix. 11) thou shalt see, O Prince of Wisdom, in this book, "which goeth before me" (Gen. xxxii. 21); and whatever thy large understand-

ing finds to criticize in it, come, "write it in a table and note it in a book" (Isa. xxx. 8); and allow me to name my work with thy name, which is glorified and greatly revered by

Thy servant,

NAPHTALI HALLEVI (i.e. the Levite).

Dated here in the city of Radom, in the province of Poland, in the month of Nisan in the year 636, according to the lesser computation (i.e. A. M. [5] 636=A.D. 1876).

In this connection it may be observed that in any complete library of Darwiniana will be found a volume by Canon Dorlodot entitled *Darwinism and Catholic Thought*. That volume attempted to do for Catholics what Hallevi had undertaken for the Jews.

As might be expected, one of the finest characterizations of the *Origin* was written by Gray, in a letter to Hooker: "It is done in a *masterly manner*. It might well have taken twenty years to produce it. It is crammed full of most interesting matter—thoroughly digested—well expressed—close, cogent, and taken as a system it makes out a better case than I had supposed possible."

But Gray was a scientist and had long been familiar with Darwin's ideas. It will be interesting to see how Darwin could impress a layman in science, the Rev. Charles Kingsley, who wrote Darwin: "All I have seen of it *awes* me; both with the heap of facts and the prestige of your name, and also with the clear intuition, that if you be right, I must give up much that I have believed and written. In that I care little. Let God be true, and every man a liar! Let us know what *is*, and follow up the villainous shifty

fox of an argument, into whatsoever unexpected bogs and brakes he may lead us, if we do but run into him at last."

How different is Kingsley's attitude from that of the Bishop of Oxford. Possibly Canon Farrar, Dean of Westminster, had the Bishop in mind when he said that, although he could not fully accept the new belief, "we should consider it disgraceful and humiliating to try to shake it by a claptrap platform appeal to the unfathomable ignorance and unlimited arrogance of a prejudiced assembly. We should blush to meet it with anathema or a sneer."

Well, what was it all about? What was this *Origin of Species* which came "into the theological world like a plough into an anthill"? What did Huxley mean when he said that it was as a flash of light to a man lost in a dark night—what road does it reveal which, though it may not take him home, goes his way? In what respect and to what extent did it revolutionize thought? What does this "grand Darwinian theory" attempt to establish or claim to prove? Was natural selection a doctrine, or a dogma, or a theory, or a hypothesis, or what? What is Darwinism?

CHAPTER XI

BUT THE "ORIGIN OF SPECIES" WEATHERED THE STORM

*But why should the theory end with man?
If he has been less, surely more he can,
And should be, by the great developing plan,
Of the grand Darwinian theory.
Why should he not on this earth yet be,
An angel, or god, like Mercury,
With a wing on each shoulder, each ankle and knee?
Oh! how delightful then it will be,
When sighing and wishing your sweetheart to see,
To wipe your beak, and just upwards flee,
Like birds—and meet your love on a tree,
On the top of a hill, by this theory.*

*Oh! hokey pokey, ringo-ging,
The world then literally on the wing;
No street cabs needed, or any such thing,
By the grand Darwinian theory.*

FIFTH VERSE, MID-VICTORIAN STUDENTS' SONG.

THE *Origin of Species* was published almost seventy years ago. There are hundreds of books about evolution. Almost every book on psychology, philosophy, sociology, anthropology, geology, and biology written in the last fifty years has accepted evolution as a fact. Almost every college in the United States has taught evolution of one kind or another for half a century. Yet nothing is more certain than that the teachers of and writers about evolution have not "sold" evolution to the American public.

The Dayton trial and the fact that there are states other than Tennessee which outlaw the teaching of evolution are symptoms of the extent of the ignorance about evolution and a proof of the fact that teachers and writers of biology have failed to tell a convincing story. Possibly, the spread of antagonism to the teaching of evolution has not reached its limit—it seems incredible that it should go further; but it is not impossible. It is conceivable that within another generation the teaching of evolution will be legally banned in half the states of the Union.

It is not our business here to attempt to analyze the opposition to Darwinism, but we are within the limits of our subject if we insist on the fact that science teachers have failed in a fundamental duty and inquire why they have failed. We shall thereby get closer to Darwin himself and gain a better understanding of just what he was driving at in his *Origin of Species*.

The first outstanding fact in this connection is that Darwin's contemporaries were unwilling, just as teachers of biology seem to-day to be unwilling, to take the trouble to find out just what he did and did not say. Thus in almost every one of a dozen books on evolution before me are chapters or parts of chapters in which the author is having a good time with himself trying to prove that Darwin's hypothesis (of natural selection) fails in this or that respect as the real cause of evolution or fails to qualify as an adequate theory of evolution. If they had read their Darwin more carefully they could have saved themselves the trouble of knocking down a straw man

of their own creation and have had time to go on with their proper business—setting forth more clearly a few of the outstanding facts of evolution.

These facts, be it noted, are *facts*; and for each fact available in Darwin's time a thousand are available to-day for any boy or girl who can read. Clarity on this point is of fundamental importance.

Recall, for example, Owen's assertion at the Oxford meeting, as to the relative amount of difference between the brain of a gorilla and that of Man as contrasted with the difference between the gorilla's brain and that of the lowest Primate. Owen was arguing that the difference between the gorilla brain and the human brain was so great that there could be no relationship between Man and ape. A thousand anatomists have since looked into that and similar questions, and volumes of facts are available to-day which prove beyond the shadow of a doubt that the brain of the gorilla and of the other three man-like or anthropoid apes is more nearly like that of Man than it is like that of any other animal. Huxley, after only a brief investigation of the subject, could declare to Owen that he was wrong, and since then innumerable workers throughout the laboratories of the world have carried on the quest of Man's likenesses and unlikenesses, similarities and dissimilarities.

We are not now concerned with the question as to whether Huxley's grandfather or his grandmother was a monkey; we are concerned with the facts which are to be found to-day in every textbook of embry-

ology, anatomy, zoology, and physiology, which prove—well, what do they prove? What can be proved from the fact that anatomically there are no differences whatsoever between Man and gorilla or chimpanzee except differences of degree comparable in a way to the differences in the human family itself? What is proved by the finding, since Darwin’s day, of a dozen missing links? What is proved by the finding of the fossil remains called *Pithecanthropus erectus*, which was so much just what its name implies, ape-man erect, that the world’s anatomists cannot agree whether he was ape or Man? What do the freely projecting tail, mammary lines, and fish-like gill clefts of a thirty-day-old human embryo prove?

These are facts we have just been speaking of. *Pithecanthropus erectus* is a fact. Piltdown Man is a fact. Heidelberg Man is a fact. The great age of these fossil remains is a fact. It is a fact that Man during his embryological development has a freely projecting tail and a neck so fish-like that only the expert can distinguish between the embryo of Man, lower mammal, reptile, and fish. It is a fact that human infants are sometimes born with a freely projecting tail; with three, four, five, or six mammary glands; with a coat of hair over the entire body. It is a fact that delicate chemical tests show a closer affinity between human and ape blood than between the blood of Man and other animals. It is a fact that no two human beings are ever absolutely alike, that they differ not only in grosser anatomical fea-

tures such as color of skin, character of hair, color of hair and eyes, shape of nose, stature, etc., but in the very bones of the skeleton, in the number of bones, in the number of muscles, in the disposition of the blood vessels, in the anatomical features of their lungs, liver, kidneys, etc.

These facts have not been thought out in the seclusion of a study, behind a furrowed brow—they have been seen and are available for anyone who has eyes to see. Such facts exist by hundreds, by thousands, by hundreds of thousands, and their number is being added to day by day. What do they prove? Well, to the moron they prove nothing; but from them the man of common sense may make certain inferences. That was what Darwin did. For nearly thirty years he had been observing; thousands and thousands of facts came under his eyes. What did they prove? Nothing. But from those facts he was led to infer that species were not, as had been claimed up to that time and as was commonly believed, immutable; he inferred, on the other hand, that species were mutable, that they had evolved from preëxisting species.

And that is all that evolution means. It is a theory, a hypothesis, an inference. The facts are thus and so. From these facts no other inference seems warranted than that the various species of animals as we find them on earth to-day, and as we find them embalmed in the crust of the earth, have not been *created* in the twinkling of an eye as it were, and out of nothing as a magician conjures a rabbit

from a hat, but that they have *evolved*; that behind these changes is a long time element during which individuals and species, and in fact all living beings, kept meeting with changing environment; and that as they themselves are in a way products of the physical and chemical environment to which they must continually respond, they must have changed, evolved.

The retort of the ignorant is that no one has ever seen the evolution of a new species. Darwin himself never maintained that he or anyone else had seen the evolution of a new species—nor has anyone yet shown every step between bulldog and greyhound; but that bulldog and greyhound are genetically related, and that both in turn are related to an earlier dog-like animal, and that bulldog, greyhound, and earlier dog-like ancestor all evolved rather than were "created," are justifiable inferences from the known facts about bulldog, greyhound, and dog-like wild animal.

Living horses walk on one toe. In more ancient days, smaller animals otherwise resembling horses walked on three toes. Before that there were still smaller horse-like animals that walked on four toes. Was each of these horse-like animals a special creation, or is the modern one-toed horse descended from a line of horse-like animals which formerly walked on three or four toes, and these presumably in turn from a more primitive animal that walked on five? The latter seems the more reasonable inference.

Evolution, then, is a theory, if you please, a hy-

pothesis which can be put to work and which yields understanding of the countless facts that have been observed by paleontologists, botanists, zoologists, anatomists, and physiologists, in short, by all who deal with living beings and their distribution in time and space. Under such a hypothesis these facts of observation become intelligible, they fall into their proper places; and above all, they can be put to the test in a scientific laboratory.

That is all that can be done in any scientific laboratory. That is what science is: the drawing of inferences from facts. If the facts are not numerous enough, or if the inferences drawn therefrom are not well and soundly drawn, it is bad science. Science itself is not the business of proving anything; it makes it its business to keep eternally curious about everything, to keep extending its observations, testing, checking up, revising its inferences. Neither the physicist nor the astronomer sets out to prove that the moon is not made of green cheese, but rather to find out what it is made of; he gets as close as he can, and from what he can learn about moon and similar bodies he draws his conclusions, makes his inferences, writes his "laws" of Nature.

When Darwin entered the field he was ready to fall in with the general theory, dogma, belief, that species did not change because God Himself had created them: they were *immutable*. Much was made in those days of the immutability of sun, moon, stars, and everything else. At that time the immutability of a cast-iron stove was as nothing compared to the

immutability of a species. Now we can better understand two things that happened to Darwin when he looked over the Galapagos Islands.

His first observation was that they were new, fresh as it were from some divine workshop, and he felt a thrill in beholding birds and other animals straight from the hand of the Creator. Then he looked again, and saw that these birds were strangely like the birds of the mainland of South America. And he naturally pondered over these two facts—the fact of mainland birds, and the fact of Galapagos Island birds. They were alike, yet they were not the same. Did they represent two distinct species, two distinct acts of creation? He was not ready to answer that question yet. The old theory, the old dogma, did not seem so good as it had before—he had his doubts. And so he went on observing, experimenting, collecting facts. He never left off collecting. We do not even know when he began to collect, but certainly at a very early age. On the *Beagle* he was an indefatigable collector of facts, ready to endure great hardship, take perilous voyages on the open sea in frail boats, long journeys across the inhospitable pampas afoot and on horseback, long expeditions into the nearly impenetrable forests of Brazil, and long laborious climbs into the mountains of Tierra del Fuego and the high Andes.

What were all those notebooks which expanded into huge portfolios but repositories of facts? Why should he go through countless dry-as-dust volumes of proceedings of Societies and Academies, in English,

in French, and in German, but to find out what had been observed and collect more facts? Why was he breeding pigeons and conducting endless experiments in specially prepared garden plots and greenhouses but to collect more facts? Why that endless correspondence with friends at home and strangers in every civilized country in the world but to extort facts? He was a walking interrogation point, curious about everything that came within reach of his eyes or ears.

Meanwhile he had, as we have seen, got an idea in his head, in fact, several ideas. He kept trying them out, testing them. Would they work? Were they any good? Were they good for helping him sum up long series of facts?

The one great idea that had come to him was that species or specific forms were not immutable. That idea became a conviction. He could not make his facts jibe with any other idea; he could not infer from all his facts that species were immutable. And so we find that the concluding line of his 1844 Sketch was: "Such are my reasons for believing that specific forms are not immutable."

Those reasons, expanded, extended, enlarged, revised, improved, he gave to the world in November, 1859, in his *Origin of Species*. That book sets forth Darwin's reasons for disagreeing with "authors of the highest eminence . . . that each species has been independently created." They could be "fully satisfied" with such a view; Darwin could not. His view was that all living beings were not "special

creations” but were the “lineal descendants of some few beings which lived long before the first bed of the Cambrian system was deposited.” And that view, we may remark incidentally, seemed to him quite as ennobling as the other view. As all living forms are lineal descendants of those which lived long before the Cambrian epoch, Darwin inferred still further—in fact, he felt certain, so strong was his inference—that “the ordinary succession by generation has never once been broken, and that no cataclysm has desolated the whole world.”

These words are found in the last two paragraphs of the *Origin of Species*. Could anything be plainer or simpler? Can anyone doubt the main point that Darwin was driving at? He was not attempting to prove anything, and above all he was not attempting to prove, nor did he anywhere in that book attempt to prove, that natural selection or any other factor was the *cause* of evolution. All he said was that he did not agree with those who held the view that each species had been independently created; he inferred that they had evolved.

Darwin’s inference is to-day accepted in full and without reservation by every naturalist of any repute in the world. There may be “authors,” and even of the highest eminence, who are satisfied that each species was independently created; there is no biologist of any eminence whatsoever who is satisfied with that view. Therein is the significance of the revolution in men’s beliefs brought about by Darwin. Other men had made guesses—and some of them very

shrewd guesses; but Darwin so presented the facts of the phenomenal world of life that no biologist could look at them thereafter and infer otherwise than that all living forms had evolved from preëxisting living forms, and so on back to the evolution of life itself from inanimate matter. Darwin took the world of living things out of the glass cases in which they had been embalmed by superstition and ignorance, and restored it to nature where men could have a look at it. That was a revolutionary proceeding. In that respect the *Origin of Species* did bring about a revolution of thought.

Darwin could have saved himself an enormous amount of time and trouble if he had not felt that he had not only to demonstrate that the evolution of species was the only inference that could be drawn from the facts of relationships and distribution of species, but that he must also show just how species originate. In other words, it is one thing to infer evolution as a working hypothesis; it is an entirely different thing to show how evolution in general or in any specific species came about.

The inference of evolution as the only hypothesis that will work is, as I have said, as firmly established and as widely accepted to-day as is any law of any science; how evolution has proceeded is still as much in dispute as it was in 1860. But let it be insisted upon again that, whether or not one accepts evolution as a valid inference from the facts, the facts themselves are unaffected by any inference that may be drawn from them; and that without the hypothesis of

evolution they remain discrete, dead, cold, and meaningless, whereas, seen against the hypothesis of evolution, they appear significant, understandable, full of life, parts, as it were, of a vast and intricate tapestry woven upon the bosom of the earth from materials that are earthy but animated by the energies of matter itself and played upon by the energy of the sun.

What, then, were the factors which in Darwin's opinion brought about the evolution of living beings? What laws, if any, did he discover had conspired to produce this marvelously variegated tapestry known as animate nature? These, "in the largest sense," were: "Growth with Reproduction; Inheritance, almost implied by Reproduction; Variability, from indirect and direct action of living conditions and from use and disuse; such a high Ratio Increase as to lead to a Struggle for Life, and as a consequence to Natural Selection, containing Divergence of Character and the Extinction of less improved forms." These "laws" are valid inferences from the known facts of living beings. Living beings grow and reproduce themselves; there is inheritance or heredity; they vary; they tend to increase faster than the food supply, or so fast relatively as to lead to a struggle for existence: hence Natural Selection—those unfit for the struggle perish, the fittest survive. These "laws" are undoubtedly factors in evolution, for, be it repeated, plants and animals have the capacity to increase in geometric ratios; while offspring resemble parents, yet they do vary; likelihood of a struggle

for existence is always arising; and the fittest would survive—having been “naturally” selected. Hence the title of Darwin’s book.

But what was plain to Darwin, and has not been so plain either to his followers or to his critics, was that the laws above enumerated are only valid “in the largest sense”—almost nothing is known of their action. Darwin, I repeat, knew this. He rarely allowed his imagination to run away with him. He knew that we know very little about growth, almost nothing about inheritance or heredity, almost nothing about the causes of variability, and that the problems of fitness, selection, survival, etc., are so intricate that only in the broadest sense can they be put to work as generalizations to help us describe what has taken place during evolution. With more exhibition of the phenomena of living beings, more insistence on the validity of the inference of evolution as a hypothesis which can be put to work to help us understand such facts, and less quibbling as to whether variability, for example, is due to Lamarckian, Mendelian, De Vriesian, or chromosomal factors, we should have fewer Daytons.

Heredity, for example, is one of the least understood phenomena of living beings; it is in itself a huge problem, the laws of which may not be completely worked out for centuries. Why then befog the issue of evolution as a working hypothesis in a bootless attempt to prove that the *Origin of Species* is inadequate because Darwin failed to show how animals do vary, and how, out of variability, nature

or anybody else could select the fittest for survival and kill off the unfit?

Darwin himself, some years later, systematized the known facts about heredity in his *Variation of Animals and Plants under Domestication*. Even so competent a biologist as Newman speaks of his attempt to interpret the facts as a "failure," because, for one reason, "there was no definite understanding about germ cells and the processes of sexual reproduction." Does Professor Newman have any "definite understanding" about germ cells and the processes of sexual reproduction?

Darwin's theory of pangenesis, propounded in that same book, had a profound idea behind it. But Darwin spent less time on it than his critics have in "exposing" it. He wanted a certain working hypothesis—he invented pangenesis. What he especially wanted was light. As he wrote Huxley: "I believe I like *pangenesis* best, though so indefinite and though my wife says it sounds wicked, like pantheism; but I am so familiar now with this word, that I cannot judge. I supplicate you to help me."

Pangenesis was sneered out of court by Weismann; he had an idea of his own to propound. Weismann's idea has been relegated to the discard by the chromosomal theory, in many respects (to me at any rate) quite as speculative as Darwin's pangenesis. To be sure, pangenesis was purely a creature of Darwin's words, while the chromosomal hypothesis is founded on things that can be seen under a microscope, but no one yet has the faintest idea what those

colored bodies are. They may prove to be the "bearers of heredity," and presumably in some way are related to the mechanism of heredity, but the fact is that, while countless facts of heredity are known, scarcely more is known about the *laws* of heredity than was known in Darwin's day.

To the criticism so often made against the *Origin*, that Darwin makes natural selection the sole factor in variability, Darwin himself, in a letter to Harvey, replies in such a masterly way that his words should be driven into the head of every naturalist who feels impelled to get ahead at the expense of a master:

It seems to me that you do not understand what I mean by Natural Selection. As my book has failed to explain my meaning, it would be hopeless to attempt it in a letter. You speak as if I had said that Natural Selection was the sole agency of modification, whereas I have over and over again, *ad nauseam*, directly said, and by order of precedence implied (what seems to me obvious) that selection can do nothing without previous variability, "nothing can be effected unless favourable variations occur." . . . The term "selection," I see, deceives many persons, though I see no more reason why it should than elective affinity, as used by the old chemists. If I had to rewrite my book I would use "natural preservation" or "naturally preserved." I should think you would as soon take an emetic as re-read any part of my book; but if you did, and were to erase selection and selected, and insert preservation and preserved, possibly the subject would be clearer. . . . About sudden jumps: I have no objection to them—they would aid me in some cases. All I can say is, that I went into the subject, and found no evidence to make me believe in jumps; and a good deal pointing in the other direction.

There are several points in that letter, but *the* point is a general one, namely, that no one realized

more fully than Darwin himself what he did not know, what he could not know, and how futile it was to try to make men see things they refused to look at.

As he wrote Gray late in 1859, he had made up his mind to be well abused, but he did think it important that his notions should be read by intelligent men; he thought they might drag after them the naturalists who were set on the idea that a species was an entity.

Darwin knew his limitations; and he knew well what he was trying to do; and even better how little he could grasp the scheme of life, how inadequate his *Origin* or any theory of natural or sexual selection was to resolve the riddle of the evolution of species.

The mere sight of a feather in a peacock's tail made him sick! Perhaps not so poetical as the flower in the crannied wall. But Darwin meant that he was so far from knowing the laws of the development of that feather that the mere sight of it made him sick. The more he thought about species, the more evident it became to him how utterly ignorant he was of the thousand contingencies on which range, frequency, and extinction of species depend. He was always repeating to himself: "We hardly know why any one single species is rare or common in the best known countries." But he could comfort himself by thinking of the future and by the belief that the problems he was approaching would some day be solved. He felt that, even though he reaped no harvest, he would have done some service if he had just broken the ground.

He once compared the then-existing knowledge of the structure of the earth to what an old hen might know of a hundred-acre field from the particular corner in which it happened to be scratching. (To get the full force of this one must remember that a hundred-acre field in England can be quite as diversified as the same amount of ground in New England.)

One correspondent objected that Darwin should not have tackled the origin of species before he had explained the origin of life, to which Darwin replied that it was surely worth while to attempt to follow out the action of electricity although it is not known what electricity is. With his profound insight into the knowable, he declared that thinking of the origin of life, for the present at any rate, was mere rubbish; "one might as well think of the origin of matter."

To Lubbock Darwin declared that there were so many valid and weighty arguments against his notions that Lubbock or anybody else could easily persuade himself that Darwin was wholly in error. Well, he said, perhaps he was wholly in error, but he himself could not see it: "I daresay, when thunder and lightning were first proved to be due to secondary causes, some regretted to give up the idea that each flash was caused by the direct act of God." And in the *Origin* itself he could say in the sixth chapter: "Long before the reader has arrived at this part of my work, a crowd of difficulties will have occurred to him. Some of them are so serious that to this day I can hardly reflect on them without being in some degree staggered."

He admitted with the utmost frankness that the work in which he had been engaged for more than twenty years would not "fix or settle anything"; but it would, he hoped, aid in the understanding of a large collection of facts. And years later he showed that he had not lost touch with reality by declaring that if he could live twenty years more he would have to modify all the points in the *Origin*: "Well, it is a beginning, and that is something." It was a beginning indeed; the whole structure of modern biology has been built upon that "beginning."

Another correspondent intimated that Darwin was too well satisfied with his work and that the conclusions he had come to were inevitable. So they were, replied Darwin, but to himself *alone*; he would be a bold man indeed to lay himself open to being thought such a complete and deliberate fool as to think his conclusions were inevitable to anybody else, nor was he to be regarded as so blind that he did not see numerous and immense difficulties in his notions. He knew "some people who never have any difficulties to speak of."

Darwin declared to another correspondent that there were many passages in the *Origin*, "put as forcibly as possible," to the effect that natural selection cannot work without the factor of variability, and that he had tried to say equally strongly that variability is governed by many laws "mostly quite unknown."

He thought possibly his use of the term "natural selection" was misleading. Wallace also had called

his attention to this fact, declaring that, while to the initiated few Darwin's personification of nature as "selecting" or "preferring," or as "seeking only the good of the species," etc., would be as clear as daylight and beautifully suggestive, it would be a stumbling-block to the careless reader. Wallace suggested, therefore, that Darwin might avoid this source of misconception by adopting Spencer's term "Survival of the Fittest." And that point was well made. Darwin personified Nature as selector merely for the sake of simplicity of expression; he did not mean to imply that Nature herself was responsible for variation. As Darwin himself put the matter in a letter to Hooker, no one objected to agriculturists using strong language about their "selection," "yet every breeder knows that he does not produce the modification he selects."

With the advent of the Dutch botanist De Vries, much was heard of the "mutation theory" of evolution. Countless experiments have been performed and observations made, especially on flowers, and long chapters have been written about mutants or sports, and entire books have been devoted to mutations as the chief or one of the chief factors in evolution. De Vries's views were welcomed because some naturalists in their impatience could not see evolution getting anywhere with what may be spoken of as the normal range of variation. De Vries had found a primrose so unlike its parents that it seemed to be a new species; it was not a mere variation—it was a jump, a sport, a mutant. But no disciple of De

Vries has got any closer to the cause of mutants than did Darwin to the cause of variability. Evolution by jumps had been looked into by Darwin—in spite of the fact that he was "pelted" with accusations to the contrary. I cannot see that the thousands of pages since written on the mutation theory have added any material point to where the question was left by Darwin.

Darwin was always ready to learn more about variation by mutation or otherwise, about the influence of environment, about the question of the inheritance of acquired characters, etc. His views on these questions kept changing, but on all these questions he was open to conviction, and on most of them scarcely any advance has been made in the last sixty-five years.

Thus Darwin could refer to Lamarck's book as "veritable rubbish." Why? For one reason, probably because early in life he was prejudiced against it; but more particularly because he regarded Lamarck as a theorist, a speculator, and because his argument was not founded on a broad basis of fact. Even as late as 1859 he declared that he had "got not a fact or idea from it." He admitted that Lamarck was no believer in the immutability of species, but thought, as we have seen, that he had so handled the subject as to do it harm. And that seems a fair indictment of Lamarck. In England, at any rate, Lamarck was not only not taken seriously but was regarded as so fantastic as to confirm men's belief in the immutability of species.

Darwin's real objection to Lamarck was the objection he had to his grandfather's *Zoonomia* on reading it a second time after an interval of ten or fifteen years—he found in both the same disproportion of speculation to facts. Lamarck's "slow willing of animals" left him cold; the same idea expressed by his grandfather in different words left him in the same frame of mind. Consider this sentence, in which his grandfather spoke of birds' beaks: "All . . . seem to have been gradually produced during many generations by the perpetual endeavour of the creatures to supply the want of food, and to have been delivered to their posterity with constant improvement of them for the purposes required." "The perpetual endeavour of the creatures" presumably was the part Darwin could not swallow.

Biologists to-day are equally loth to swallow that idea; they cannot see how the constant improvement brought about by the "perpetual endeavour" can be transmitted. In other words, the theory of evolution as first propounded by Lamarck in 1801, and enlarged in his *Philosophie Zoologique* in 1809, and known as the inheritance of acquired characters, has not met with general acceptance. But it is one thing to repudiate, as did Lamarck's contemporaries, Darwin, and the public at large, "desire" or "need" as a factor of evolution; it is an altogether different thing to deny the possibility of the transmission of acquired characters. As a matter of fact, Darwin himself had an entirely open mind on that question, and in the historic Sketch which precedes his *Origin*

of *Species* he spoke of Lamarck as ‘‘the justly celebrated naturalist’’ and gave him credit for upholding the doctrine that species, including Man, are descended from other species; and added that Lamarck was the first to perform the eminent service of arousing attention to the probability of all change in the organic as well as in the inorganic world being the result of law and not of miraculous intervention. As a matter of fact, the attention Lamarck ‘‘aroused’’ was practically nil, and it is only fair to that great and much misunderstood genius to say that the fact that he did not arouse more attention was, in part at least, due to Darwin himself. For more than a century Lamarck’s views were buried with him in an obscure grave, to be made a butt of when brought to light or satirized in such lines as Lowell used in his *Biglow Papers*:

Some filosifers think that a fakkilty’s granted
The minnit it’s felt to be thoroughly wanted.

.

That the fears of a monkey whose holt chanced to fail
Drew the vertibry out to a prehensile tail.

Darwin was as fair a man as ever lived; it was in keeping with his character that he made such amends as seemed to him honorable for the early slight he had put upon Lamarck. Thus only seven years before he died, referring to the Lamarckian factor in a letter to Galton, he declared that every year he had come to attribute more and more to such agency. And we seem to be justified in saying that, had not

the stress of other labors prevented him later from again revising his *Origin*, he would have incorporated the principle of the transmission of acquired characters as among the factors in variability. Countless experiments, many of them stupid, have been performed in the name of science to test the Lamarckian factor in evolution. Little if anything positive has yet come out of these experiments, but that there is a profound truth in that hypothesis seems to the writer inevitable. If we only knew a little more about heredity! If Nature herself were not so vast and complex, so baffling!

But note this: that whether variation be by minute increments or by leaps, and whether a character acquired during the lifetime of an individual be transmitted or not, the Darwinian principle is none the less operative: *Natural selection applies to all that is embraced within the term Lamarckianism, and much more.* Natural selection has taken place. Nature does select. As Darwin put it in his *Origin of Species*, Man has been trying an experiment on a gigantic scale; that experiment Nature has been incessantly trying and during a long lapse of time.

What is Nature? That is known yet only in part; vastly more to-day than was known in Darwin's day, but not enough to make the *Origin of Species* the rubbish he predicted it might become. It will remain as the foundation stone of all biologic science.

Nature is larger and more elusive than she was deemed to be a hundred, or fifty, or even ten years ago. In fact, she is so elusive in the incredibly com-

plex form in which she offers herself as living organisms that biochemists almost despair of solving the riddle; nor are they content to solve problems by merely naming them. Naturalists, on the other hand, are still prone to invent terms to mask their ignorance. Thus a recent book on the origin and evolution of life, in referring to the phases presented by "adaptive characters," speaks of "*the more or less rapid acceleration or retardation of character form and function.*" The word "adaptive" moves us forward not an inch in understanding either the origin or evolution of life; "acceleration" and "retardation" are old terms used long ago by Hyatt and Cope. What do they mean? They are in a class with Lamarck's "willing" and Erasmus Darwin's "endeavour." Imagine a physicist trying to get along with such terminology! Darwin himself fifty years ago struggled over an attempt to grasp the meaning of "acceleration" and "retardation," and gave up "in despair."

A wag once suggested that the Homer controversy be closed with the agreement that the *Iliad* was written by another man of the same name. The idea has been suggested to cover the case of biologists who parade the changes they assume to be necessary in the Darwinian hypothesis of evolution—they can save their face by calling the same thing by another name. But proud as Darwin had reason to be of his work, we can feel fairly certain that that kind of a controversy would not have moved him very deeply; for, as he wrote in a letter to the *Athenæum* in 1863, whether one believes in the views of Lamarck, St.

Hilaire, Robert Chambers, Wallace, or himself, or in any other such view, "signifies extremely little in comparison with the admission that species have descended from other species, and have not been created immutable; for he who admits this as a great truth has a wide field opened to him for further inquiry."

And right there we may suspect Darwin felt that he had found the answer to the secret that had intrigued him as a child. True, he had not learned what life is, but he had learned what Hutton had learned in 1788 and what Lyell had set forth in 1830 regarding the inorganic world: that in the living world uniformity also prevails; that the past must be inferred from the present; and that species have not been created immutable but have evolved from other species. And the past being thus discovered, a wide field was opened up for further inquiry. The great truth which he discovered was that the organic no less than the inorganic world has evolved, and he so set forth that truth that men believed.

November, 1859, marks the beginning of the acceptance of the hypothesis of evolution. The word itself must remain synonymous with Darwinism.

CHAPTER XII

HIS MANY OTHER LITERARY CHILDREN

I shan't be easy till I've tried it. I am like a gambler, and love a wild experiment.

DARWIN.

THE *Origin of Species* is merely the best known of Darwin's writings. Had he not written that book, nor formulated the law of natural selection as a substitute for the law of special creation, the amount and character of his work in other fields of science were such as to entitle him to first rank for all time.

It will be recalled that the *Origin of Species* was regarded by Darwin as an "Abstract." He intended to follow it up with several volumes which would more fully document the reasons which led him to infer that species had evolved rather than were created. But the reception of the *Origin* made such vast additional documentation unnecessary. Then, too, he was "fairly paralyzed how to begin and how to end, and what to do" with his "huge piles of materials"—he was "a complete millionaire in odd and curious little facts." The one portion of his then projected work ever actually published was *Variation of Animals and Plants under Domestication*, in two volumes, in 1868. It created a profound impression in the scientific world.

Darwin wrote about twenty volumes, besides eighty-two papers or articles for scientific societies and journals. These together covered practically the entire range of geology and natural science. Most of them, of course, have been superseded by more advanced work. Plant physiology, for example, is a new science. Darwin laid its foundations and made first-class contributions, but the young student of botany to-day does not begin with Darwin. Hence, while these various books and papers on natural history and geological subjects will always be of interest and importance in the history of science, their value will steadily diminish as each particular science changes its point of view and takes on new interests. But the point is that to geology and in various fields of botany and zoology Darwin did make real and great contributions. Each science is indebted to him as it is indebted to a pioneer who clears the field and makes it forever after easier for those who are to follow.

All we can do is to glance at the more important of his writings, and peep into his greenhouses and laboratory to get an idea of how he worked. Thereby we shall see how his insatiable curiosity was always urging him on to try out things that had never been tried out, and to formulate questions about problems which up to his time had not even been raised. A fairly complete list of Darwin's books and writings will be found in Appendix II.

Darwin's first scientific work of any importance was his *Geology of the Voyage of the Beagle*. It is

stamped with marvelous acuteness of observation, great sagacity in bringing together scattered facts, and a far-reaching vision never till then and rarely since equaled. Especially valuable were the parts dealing with volcanoes and earthquakes, the subsidence of sea bottoms, the elevation of mountains and continents, and the foliation and cleavage of rocks and the earth's crust. His observations on the Volcanic Islands are even to-day the best authority on the general geologic structure of the regions he described. He was one of the earliest geologists to recognize the extent of the denuding action of water upon geologic formations, and among the earliest of the English contributors to set forth the action of glaciers in Great Britain. His chapter "On the Imperfection of the Geological Record" in his *Origin of Species* startled geologists from a profound slumber, so blissfully unconscious had they been of the fragmentary character of the record. Darwin showed how that record was inevitably intermittent and fragmentary. The view that the sudden appearance of groups of species of fossils on certain horizons was proof of the doctrine of special creations and cataclysms, was challenged with great boldness. His two chapters on geographical distribution opened up vast fields of research.

The little volume, the *Structure and Distribution of Coral Reefs*, in 1842, was characterized by Geikie as the most original of all Darwin's geologic work and destined to remain one of the classics of geological literature. It was one of the most admirable ex-

amples of scientific method ever given to the world. Had he written nothing else, *Coral Reefs* would have placed him in the very front rank of the investigators of Nature. So startling was his theory of the formation of coral reefs that even Lyell could not accept it at first, but after having talked it over with Darwin in 1837, he was so profoundly impressed that he wrote: "I could think of nothing else for days. . . . It is all true, but do not flatter yourself that you will be believed till you are growing bald like me, with hard work and vexation at the incredulity of the world."

And what a prophetic letter it was that Darwin wrote to Agassiz in 1881—that he wished some doubly rich millionaire would take it into his head to have borings made in some of the coral atolls. That practical test of Darwin's theory was made independently by different expeditions years later, one of them being made by the son of the great Agassiz himself. As a result of those deep borings, not only were Darwin's theories as to their origin confirmed, but his contention of the permanence of ocean basins and continental areas, maintained single-handed against Lyell, Hooker, and Wallace, was also thereby given confirmation.

One of Darwin's earliest geological papers was a little sketch, showing patient observation and shrewd inference, "On the Formation of Mould," read before the Geological Society and printed as a five-page paper in the *Transactions* in 1840. Forty years later Darwin was to take up that little paper and spend months on it, printing it in 1881 under the title *The*

Formation of Vegetable Mould, through the Action of Worms, with Observations on their Habits. It was his last book and almost his last work. In its preparation he carried on many experiments and a long series of observations—his “whole soul” was “absorbed with worms.” And why not? They pass ten tons of soil per acre through their bodies each year! The success of this “worm book” was “almost laughable.” The first edition of 2,000 copies was immediately sold, and within three years after its publication more than 8,500 copies had been sold, relatively more than had been sold of the *Origin of Species*. Darwin was “plagued with an endless stream of letters on the subject.”

“In the eyes of most men,” said a reviewer of the book, “the earthworm is a mere blind, dumb, senseless, and unpleasantly slimy annelid. Mr. Darwin undertakes to rehabilitate his character, and the earthworm steps forth at once as an intelligent and beneficent personage, a worker of vast geological changes, a planer down of mountain sides . . . a friend of man . . . and an ally of the Society for the preservation of ancient monuments.” And the latest verdict of modern science is that, apart from certain kinds of bacteria, no organism has contributed so much to make the earth habitable for Man and higher animals as this same earthworm.

Darwin’s greatest single work in zoology was on those curious little marine forms generally known as barnacles, an animal which stands on its head in the bottom of its shell cup and kicks its food into its

mouth with its feet. This work consumed eight years and resulted in two thick folio volumes covering all the living species, and two thin volumes on extinct species, the whole forming a monograph of a thousand pages. And all because off Chile he had found a barnacle so different from all others he had seen that he began to dissect the common forms to understand his new find. At the end of his great work he cleaned out of the house and distributed more than 10,000 species of barnacles.

That work represented huge patience and remarkable powers of research in anatomical investigation, physiological experiment, and philosophic generalization. He took up his barnacle work with great interest because he found it delightful, after his geological observations, to use his eyes and fingers again; but before he got through he hated barnacles as no man ever did before, "not even a sailor in a slow sailing ship." But he kept his enthusiasm alive. He thus describes one of his "finds" to Lyell—a female with "two little pockets, in *each* of which she kept a little husband; I do not know of any other case where a female invariably has two husbands. . . . Truly the schemes and wonders of Nature are illimitable."

Darwin made no pretence of being a botanist—for that matter he made no pretence of being anything—but he did first-class original work in botany and made permanent contributions of great value to that science. He approached the plant world, even as he had the world of animals and the structure of the

earth itself, almost free from academic prepossessions. As a result, facts did not scare him, nor was he deterred from formulating hypotheses, however startling; thus he reached many general conclusions, especially in the realm of fertilization of plants, their power of movement, and the physiological processes involved in insect-devouring plants. His experiments to determine the longevity of seeds under various conditions, and their means of transportation, were both original and ingenious, and some subjects required more than a dozen years of experimentation.

It has been said of him, in relation to plants, that he seemed by gentle persuasion to penetrate that reserve of Nature which baffles smaller men. And a first-class botanist declared that each one of his botanical investigations on its own merit would have made the reputation of any ordinary botanist. His son Francis took an active interest in his work and himself became a distinguished botanist.

We might think that Darwin would be too busy digging himself out of the avalanche of opinion let loose by the *Origin of Species* to be actively engaged in research in 1860, yet how different is the picture revealed by a few lines to Lyell toward the end of that year. He is postponing the publication of his work on *Drosera* (Sundew, a plant which derives its nitrogen from the capture and digestion of insects) because he is "frightened and astounded" at his results: "I declare it is a certain fact, that one organ is so sensitive to touch, that a weight seventy-eight times less than that, viz., 1-1000 of a grain, which will

move the best chemical balance, suffices to cause a conspicuous movement. Is it not curious that a plant should be far more sensitive to the touch than any nerve in the human body? Yet I am perfectly sure that this is true. When I am on my hobby-horse, I never can resist telling my friends how well my hobby goes, so you must forgive the rider."

He spoke of the endless experiments he had performed to ascertain the almost infinitesimal amount of nitrate of ammonia they could detect; but the nitrogen in muriate or sulphate of ammonia "bothered their chemical skill." Later he spoke of half killing himself with microscopic work on plants. He had begun to think them more wonderful than animals.

Endless experiments and an unending stream of letters to near-by and remote friends for specimens, for observations, criticism, help. "A lot of seeds arrive and are all sown, but don't answer, I am all on fire with my work." Or again, he has nursed a certain plant like the tenderest infant; if it dies he will feel like a murderer. They are wonderful creatures, these orchids, "so baffling that I was a fool ever to touch them." Yet he could be enormously pleased that a reader of his orchid book had admired his "beloved orchids,—I quite agree they are intellectual beings."

In working out his theory of evolution as opposed to special creation, it became of enormous importance to him to be able to show, as he believed, how both plants and animals could be carried long distances.

Then, too, these problems had their own interest in the matter of the distribution of both plants and animals. He asks a school-teacher friend to offer to his schoolboys a reward of two shillings a dozen for lizard eggs—and if they get snake eggs by mistake it will be all right. What does he want with lizard eggs? To see whether they will float on sea water and whether they will keep alive in sea water for a month or two. “I am trying experiments on transportation of all organic beings that I can; and lizards are found on every island, and therefore I am very anxious to see whether their eggs stand sea water.”

Through such an experiment, for example, he found, to his surprise, that celery and onion seed would come up after eighty-five days’ immersion in salt water—he thought that would throw light on the wide dispersal of certain plants. And another time he bursts into a “Hurrah! a seed has just germinated after twenty-one and a half hours in an owl’s stomach. This would carry it God knows how many miles.” He thought an owl might possibly go 500 miles in a storm in that time.

He cannot understand the absence of certain plants in the Island of St. Helena, hence he requests a cask of earth from a few inches beneath the surface and from a dried-up pond, “and thus, as sure as I’m a wriggler, I should receive a multitude of lost plants.”

Francis one day asked him why a bird that had been killed by a hawk, or by lightning, or apoplexy, with seed in its crop, should not float for a long time.

"No sooner said than done: a pigeon has floated for thirty days in salt water with seeds in its crop, and they have grown splendidly." But would not gulls, etc., eat up the carcass of a dead bird? Generally, yes; but one might escape: "I have seen dead land birds in sea drift."

He had also seen locusts blown far out to sea. He once caught one 370 miles off the coast of Africa. Hence, when a friend sent him a small packet of dried locust dung from Natal, he promptly planted it, and seven plants came up.

We have an example of the extraordinary keenness of his eye in the following incident. He had read in a scientific journal of a partridge foot with a ball of earth attached to it as hard as rock. The man who found the foot had described it just that way; he saw only the foot and the ball of earth. Darwin sent for the foot, found that it was diseased, and that the escape of blood serum presumably caused the earth to accumulate on the bird's foot. From that earth he grew thirty-two plants.

How are fresh-water shellfish distributed? That was a "horrid incubus" to Darwin for a while, but he had to account for it. He discovered that the eggs when first hatched are very active. He found forty on a dead duck's foot, so firmly attached they could not be jerked off, and that they would live for twenty-four hours out of water.

He accuses Hooker of not sending him a certain ripe pod, "for fear I should float it from New Zealand to Chile."

But sometimes his swans turned out geese, for as he said regarding certain experiments: "If the confounded seeds will sink, I have been taking all this trouble of salting the ungrateful rascals for nothing." He asks Hooker to do certain things with certain seeds—"an experiment after my own heart, with chances a thousand to one against its success."

But he was ever a good gambler and ready to take a chance, and as a rule he got more swans than geese. For example, he found that fish will greedily eat seeds of aquatic grasses, storks will eat fish, the seeds in their droppings will germinate—which reminded Darwin of the nursery rhyme, "This is the stick that beats the pig, ' etc.; or, as we would say, "This is the house that Jack built." And this in turn suggests the cat-and-clover story started by Darwin and completed by Huxley: Old maids keep cats, which eat mice, which destroy bumblebees' nests; bumblebees fertilize red clover, which nourishes cattle, which feed sailors, who help Britannia rule the waves; hence England's position as mistress of the seas depends on her crop of old maids!

Some of Darwin's keenest observations were made on his weed garden, a little plot two by three. It was there that he began to see, though on an infinitely small scale, how the struggle for existence went on. He daily marked each seedling as it appeared, and found that of 357 that came up 277 were killed, chiefly by slugs. "What a wondrous problem it is, what a play of forces, determining the kind and proportion of each plant in a square yard of turf!

It is to my mind truly wonderful. And yet we are pleased to wonder when some animal or plant becomes extinct." He not only found time to do these myriads of things but to wonder about them, to record them, to get excited about them, to love them, to understand them.

Another instance of his keen observation is his noting the fact that on one square yard of heath close cropped by cattle were thirty-two tiny trees struggling to raise their heads above the stems of the heath. One of them, as proved by its rings, was twenty-six years old!

He begs a friend, "for the love of heaven and all the saints," to send him a few certain flowers in a tin box with damp moss. He feels "like an old war horse at the sound of the trumpet" when he reads of the capture of a rare beetle. He advises a friend to be prudent: "For heaven's sake take care of your fingers; to burn them severely, as I have done, is very unpleasant." He wants a certain plant famous for closing its leaves promptly in the dark, to see if he cannot teach it to close by itself. He is delighted to learn how an experiment that Hooker is performing for him has turned out; if he had lived till he was a hundred, he would have felt uneasy about it. Another observation pleased him so much that he could not sit still for half an hour. He wanted to know if the far-famed Bower-Bird could distinguish colors, and sent bits of colored worsted yarn to a correspondent who was in a position to observe, asking him to remove all colored worsted from the cage and bower

and then put in a row at some distance the worsted he had sent; and gave further directions as to how the experiment could be made to discover whether the bird could discriminate between colors or preferred one to another.

That endless succession of children the stork left at Down House, the endless stream of visitors. . . . Did ever man live such a busy life! And yet he could find time for everything, even to tell Hooker about a *splendid instance* related to him by a man who had caught Darwin's fever for planting seeds from sub-soil. He had planted some from the lower part of the London clay and claimed that seeds came up alive out of it!!! "I disgusted him by telling him that palms ought to have come up"!

So-called secondary sexual characters—that is, such characters as appear in each sex, especially in higher animals, after the sex glands have matured—were tackled by Darwin with his customary vigor; in fact, it was one of the problems that intrigued him for many years, and he was led finally to propound the theory of sexual selection to account for such characters. With the modern view, reached after much observation and experiment, that secondary sexual characters are dependent on the functioning of the sex glands as endocrine organs or glands of internal secretion, the problem as Darwin saw it has for the present ceased to exist, but in one sense it is no more solved than when he tackled it.

One illustration must suffice as showing the character of some of the observations he made. Thus he

wrote: "The case of the starling married thrice in one day is capital, and beats the case of the magpies of which one was shot seven times consecutively. A gamekeeper here tells me that he has repeatedly shot one of a pair of jays, and it has always been immediately replaced. I begin to think that the pairing of birds must be as delicate and tedious an operation as the pairing of young gentlemen and ladies."

It should be obvious by this time that Darwin was a scientist. He used his sense organs for his observations, and his speech apparatus to describe them and from them draw such inferences as seemed warranted. He may not inappropriately be called the first behaviorist.

His observations were not always numerous enough to yield entirely satisfactory results, but the value of his work lies essentially in the fact that he was bold enough to formulate hypotheses. Thus he asked one correspondent to forgive him for a suggestion that, as Demosthenes had declared *Action, Action, Action*, was the soul of eloquence, so caution was almost the soul of science, and yet caution alone was as barren as a vestal virgin. It was a duty to generalize as far as could be done safely. It ought never to be forgotten, he wrote, that the observer can generalize his own observations incomparably better than anyone else. He spoke of astronomers who observed all their lives and never drew a single conclusion, and quoted Herschel to the effect that it would have been much better if they had paused in their devoted work to see what they could deduce

from it. Hence, though his extraordinarily active life was literally crammed full of observation and experiment, he was equally keen on pointing laws, drawing inferences, formulating hypotheses.

I spoke of Darwin as a behaviorist. Even in the realm of psychology he was in some respects sixty or seventy years ahead of his time. But it is too much to expect that he would try to find a substitute for the concept "mind," for example, which as a pure behaviorist he was entitled to do. "Mind" then was too naïvely accepted by everyone for even Darwin to question its existence, or to ask of himself or of psychologists what it was. In this one great respect he forgot, as he was always trying not to forget, his ignorance, because to remember his ignorance meant to work to remedy it.

Darwin followed his great work on the *Variation of Animals and Plants under Domestication* with two volumes on the *Descent of Man* and one volume on the *Expression of the Emotions in Man and Animals*. Of the two volumes on the *Descent of Man*, nearly half the first volume and practically all of the second are devoted to his theory of Sexual Selection. The chapters which relate to the evolution of Man marked a distinct advance at the time, but they are now largely of historic interest because of the enormously extended light thrown on Man's evolution by modern discoveries in comparative anatomy, embryology, and physiology, and especially in the paleontological record. As has already been suggested, the finding of *Pithecanthropus erectus* in Java was just such a

missing link as Darwin himself might have postulated; if it had been made to order it could not have been better.

Throughout the *Descent* Darwin gives evidence of having been a careful student of such material as was available at that time, and in one remark alone shows how thoroughly well grounded he was in the comparative anatomy of Man's nearest-of-kin; in referring to certain naturalists who had placed Man in a separate order, he says: "If Man had not been his own classifier, he would never have thought of founding a separate order for his own reception."

Darwin's attitude toward the *Descent* is set forth in its introduction. For years he had collected notes on the origin or descent of Man, not only without intending to publish on the subject but rather with the determination not to publish. This may be thought curious, but from the point of view of the time when he began preparing his notes, it was a sound conclusion. The thesis, which to him had vital importance, was that of selection by nature rather than creation by supernatural agency. He wanted to do nothing which would prejudice the acceptance of that thesis, but he did say even in the first edition of the *Origin* that that work would throw light on the origin of Man and his history; implying, in other words, that "Man must be included with other organic beings in any general conclusion respecting his manner of appearance on this earth." And as Darwin said at another time, to have included the question of Man's origin prominently in the

Origin of Species would have raised an almost insurmountable barrier to its reception.

Darwin apparently expected his *Origin* to meet with more opposition than it did on the part of naturalists, but when within ten years the National Institute of Geneva could declare that no one in Europe any longer believed in the independent creation of species, he felt more than justified in working over his old notes in relation to the origin of Man, adding to them, and publishing them.

How far Darwin might have gone in his *Descent* and *Emotions* if he had dispensed with the assumption that Man or other animal has a mind it is impossible to say, but if he had limited himself to the observable his contributions to psychology might have been on a par with those he made in other fields of science. But so deep-rooted was and is the "conviction" that both men and other animals have minds (or souls) that most psychologists even to-day keep talking about them as though they were as definite and tangible mechanisms as motor engines, contracting muscles, or secreting glands, and make them responsible for definite forms of behavior. Not only do psychologists still employ the concept mind as the responsible party in certain forms of behavior: the concept itself is naively assumed by many physicists of eminence and by the public at large. Even the French Academy has just declared, by a vote of eight to five, that animals have souls.

Darwin felt impelled to discuss the origin of the "moral sense" in his *Descent of Man* because, as he

said, while it had been discussed by writers of consummate ability, no one had yet approached it exclusively from the side of natural history. He tried to discuss it as a scientist, but made no more progress with it than psychologists do now. He presupposed the existence of a moral sense; he should first have inquired whether such a thing exists.

We know from his autobiographical sketch that he began observing his first child from birth, and that he continued to collect notes on the expression of the emotions. It became one of his hobbies. He feared, he wrote Gray once, that he would not be able to make as much of it as he had thought, but it did seem to him a curious subject which had been strangely neglected.

His method, I repeat, was that of a true behaviorist; the method failed to yield results because he was not at all clear what he was trying to observe. Thus he asked Romanes if he had ever thought of keeping a young monkey so as to observe its "mind." In the same letter he compared the behavior of a young monkey with that of one of his grandchildren of less than two years, and from his observations concluded that the child of less than two was inferior in "intellect" to a young monkey. Apparently it did not occur to him to define intellect. But as showing the attitude of the family regarding such matters, the father of the two-year-old suggested to Darwin to tell Romanes that to make really good comparative observations he should keep an idiot, a deaf mute, a monkey, and a baby in the house! Comparative

studies on the development of four such individuals should have proved of value.

The keenness of Darwin's insight, as well as his method of approaching a problem, are beautifully illustrated in a letter to a friend in Brazil who had declared that an old Negro woman when expressing astonishment closely resembled an astonished Cebus monkey. But, Darwin asked: "Are you sure that the Cebus opened its mouth? I ask because the chimpanzee does not open its mouth when astonished or when listening." And he asked his correspondent to remember that he was very anxious to know whether a monkey screaming violently partially or wholly closed its eyes.

This objective method of gaining information naturally yielded very definite results along certain lines. For example, Darwin's description of Man and animals when strongly moved by fear or rage is far superior to William James's handling of emotions. Darwin described what he had observed; James dispensed with observations and tried to describe emotions by merely thinking about them. In many respects Darwin was the better psychologist of the two.

Curiously enough, the *Expression of the Emotions*, which cost Darwin about twelve months' actual work, sold at first extremely well, 5,267 copies being sold on the day of publication, and Darwin collected a mass of notes which he intended to use in a second edition. But after the first impetus the sale of the book fell off rapidly and Darwin never got around to the preparation of a second edition.

Darwin was ready at all times to abandon any hypothesis which he could not make work; nor was he afraid to examine any concept—such as soul, mind, mental faculty, etc.—because of any feeling of reverence or awe for it. But so much of his life had already been absorbed in the broader, greater problems of origins, that when he came to speak of the descent of Man he took Man as he found him, including acceptance of the validity of the common concepts of mind, instinct, moral sense, intelligence, etc., etc. But possibly had he even questioned the existence of mind, his *Origin of Species* would have been regarded as the work of a madman and his *Descent of Man* never have been published. There is such a thing as being too far ahead of one's time.

CHAPTER XIII

HE HAD TO LEARN TO WRITE

I must write what will be read.—DARWIN.

DARWIN'S life was a success: whatever he touched he improved, and shared the profits with the world at large. He found no short cut to success; none of his achievements was the result of what we might call luck. They all resulted from patience, from hard work—it was “dogged as” did it. His success as an author resulted from that same patience, hard work, doggedness. And he was a success as an author, successful beyond his own hopes and anticipations.

The story Darwin told in the *Origin of Species* might have died the day it was born had not he himself, in the best sense of the word, sold it to the public. It was a new story; to many an astounding and impudent story, to the vast majority an improper and even a sacrilegious story. But it did sell.

The first edition was sold on the day of publication; the second edition, twice the size of the first, went equally fast. It went through six editions in Darwin's lifetime; and by 1885 more than 40,000 copies had been sold in England alone. It was translated into almost every European tongue, including Span-

ish, Czech, Polish, Russian, and Hebrew. "Considering how stiff a book" it was, the sale was remarkable.

Almost without exception Darwin's works were "best-sellers." They attained a larger circulation than did any other scientific writings ever produced, and in translations were read by a wider circle than had ever read the works of any other naturalist. His success as an author was not less than his success as a scientist, as a family man of understanding, and as a citizen keenly interested in the righteousness of the State.

What was behind this success as an author—was it due merely to the kind of story he had to tell or to the way he wrote it, or to both? And if both, what were the factors in each which made for success?

It has been argued that the success of the *Origin of Species*, for example, was due to the fact that the idea was in the air. Darwin could not see it that way at all. He repeatedly sounded out naturalists without coming across a single one who had any doubt about the immutability of species. Lyell and Hooker would listen with interest but without agreement. He would try to explain what he meant by natural selection, and fail.

The *Origin* succeeded, Darwin thought, because it furnished an adequate theory for many facts with which naturalists were familiar. That, as we have seen, was Huxley's idea also: it came as a light to naturalists groping in the dark. Its success was also due, Darwin thought, to its being a moderate-

sized book. Had he published it on the scale begun in 1856, making a work four or five times as large as the published volume, few would have had the patience to read it. In other words, the mere mechanics of the book were a factor in its success. It was a success because it was a good story and because it was well told. Darwin himself was "sold" on his story; he was far from convinced that he could sell it to others—hence its almost pathetic tone, the reverse of a fanatic who would force his story on unbelieving readers.

The sale of the *Origin* tells its own story, but a little story told in the *Life of Sir John Lubbock* goes far in telling a big story. Shortly after the publication of the *Origin* the wife of the Chancellor of the Exchequer asked the President of the College of Surgeons why one germ should develop into a man and another into a kangaroo. He told her to read the *Origin*. She did; and exclaimed: "Well, I don't see much in your Mr. Darwin after all; if I had had his facts I should have come to the same conclusion myself."

One of the least understood phenomena in nature in 1859 was the wide difference in higher organisms between embryo and adult, and the very close resemblance between embryos in the same class of animals. These differences and resemblances are intelligible only on the hypothesis of evolution; on any other hypothesis they are chaotic. Darwin saw the importance of this evidence: hardly a point, he tells us, gave him so much satisfaction as the useful-

ness of his hypothesis of evolution in understanding the facts of comparative embryology. In this he was far in advance of his time, hardly any of the anatomists paid any attention to it; but he gave his evidence so quietly that it aroused no opposition and it was quite overlooked by his reviewers. It remained for two German naturalists, Mueller and Haeckel, to "sell" the story of embryology.

Which is to say: Darwin usually knew what he was trying to do. He was often in the dark, but in the vast majority of cases he knew the difference between light and darkness, and darkness gave him no satisfaction. But he would not force light on unwilling eyes.

Darwin had a Golden Rule: to make a note at once of any published fact, observation, or thought opposed to his general results. As a result of his following that rule, his critics had to work hard to find an objection to his views which he had not at least noticed and attempted to answer. One other fact should be noted: his important books and papers are more or less abstracts or condensations of great series of facts and collections. He was not trying to expand a 20-page paper into a 200-page book, or a 200-page book into three volumes of 400 pages each; rather, both his papers and his books represented the cream of materials which could easily have been expanded into heavy, cumbersome volumes.

He spent much time in planning the general arrangement of his more important books. He would first make out a rude outline of two or three pages,

then a larger outline. The headings would again be enlarged. Thus he had a scenario of his story before he began to write it out.

He kept from thirty to forty large portfolios in cabinets, with each shelf labeled. He bought every book he thought he ought to have. At the end of each book he made an index of all the facts that concerned his own work, and in drawers he kept abstracts of all the books he borrowed: "I have all the information collected during my life ready for use."

Darwin had no respect for books, as books. He collected them as he collected other things, as materials from which he could deduce laws or as tools with which he could make things. A book was a tool to be worked with, and if he found it too cumbersome to hold easily in his hand, he would cut it in two! Lyell published the second edition of one of his books in two volumes because Darwin told him he had had to cut the first edition in half in order to hold it. He asked Lyell to advise his publisher to bring the next edition out in two volumes even if he had to increase the price by one or two shillings: "You thus might originate a change which would be a blessing to all weak-handed readers." He suggested a second real blessing: "Have the pages cut, like the Yankees do; I will heap blessings on your head." If he found a pamphlet which had ten pages of meat and forty pages of refuse, he would tear out and throw away the refuse. His library was useful rather than ornamental. It must have been a striking library.

Another element of his success as an author was

pride in his work and in his success, and the fact that whatever skill he came to have as a writer he acquired only after long effort to solve the problem of writing well.

Even when his fame had circled the globe his pride in his success as an author was not less than it had been when he had published his first volume: if he lives till he is eighty he will never cease marveling at finding himself an author, he declared; he wrote Henslow that if anybody had told him before he started to write a book that he would be an angel by this time, he would have thought it an equal impossibility. And he sat "gazing in silent admiration at the first page" of his new volume. His exuberance of vanity when he found that the American geologist Dana had stamped his coral reef theories with approval was such that he just had to sit down and write Lyell: "To begin with a modest speech, *I am astonished at my own accuracy!!*" Pride, vanity? Yes. But surely if any man was ever entitled to be vain, it was Darwin. And be it noted, that vanity never saw the light of day except in the intimacy of private correspondence with a personal friend, and then it was always child-like and naive.

The success of the *Origin of Species* made him "feel inclined to strut like a turkey-cock," he wrote Hooker. But when a friend wrote Mrs. Darwin that she had heard a man inquiring for it at the Waterloo Bridge Railway Station, and the bookseller replied that he had not read it but "had heard it was a very remarkable book"—that *was* fame! The entomologists

might hold the story back fifty years, but when a railway-station bookseller spoke of the *Origin of Species* as a "very remarkable book," nothing could stop it! And he felt so good he just had to write Lyell about it.

While Darwin valued the bauble fame, yet if he knew himself, he said, he would have worked "just as hard" if he had known that his *Origin of Species* would be published forever anonymously; but he thought that he could not have put the same amount of "gusto" into it. His published books, he said, were "milestones" in his life.

And every milestone cost him great effort, for, as he said a dozen times, he found it unutterably difficult to write clearly and concisely—that there was a "fatality" which forced him to write wrongly or awkwardly. It seems more likely that fate had nothing to do with it; as he had never learned to read German easily, so he had never learned to write clearly and concisely. But he did learn to write clearly and concisely, as he learned to read German, by hammering away at it.

He finally developed a technique: to drive ahead with his first draft in a vile hand as hard as he could drive, regardless of what he was getting down, intent on getting something down; then he would go over it, painstakingly, laboriously, deliberately, and make the page say what he wanted it to say. He could have saved himself untold anguish if in early life he had learned to write simple English.

We find abundant evidence in his letters of what

it meant to him to have to expend so much time in preparing his materials for publication. "The devil take the whole book!" he exclaims; "and yet now I am at work again as hard as I am able." Or, as he wrote Hooker, he is at the same work as before—"putting ugly sentences rather straighter; and I am sick of the work, and, as the subject is all on sexual selection, I am weary of everlasting males and females, cocks and hens. . . . Farewell. I am as dull as a duck, both male and female."

What has he been doing? "Nothing but blackening accursed proofs with corrections. I do not believe any man in England naturally writes so vile a style as I do." After having been "absorbed" for days in revising a manuscript, he had come to "love the whole subject like tartar emetic." Part of a manuscript was lost on its way back from the publisher, but he has the old manuscript, "otherwise the loss would have killed me." He has just finished correcting proof—"the neck of my work, thank God, is broken. . . . Good heavens, the relief to my head and body to banish the whole subject from my mind!" Another book that he thought "decently written" he finds wants so much rewriting that he is "ready to commit suicide."

Like living itself, writing did not come easily to Darwin, but with writing as with living he never gave up; and as he lived a simple, naïve life without pretence, so what he wrote appears simple, naïve, utterly without pretence. He could attain that style because of a deep-seated impulse: he kept telling

himself he must write what would be read. When he found a hopelessly involved sentence he would ask himself: "Now, what *do* you want to say?" Francis tells us how his children laughed at a complicated sentence he had read them from a manuscript; they compared it with an advertisement!

Hooker submitted to Darwin an inscription he had prepared for the Lyell memorial. Darwin was "sorry" for him—it "has almost burst me. We think there are too many plurals, and when read aloud it hisses like a goose. I think the omission of some words makes it much stronger. 'World' is much stronger and truer than 'public.' . . . God help you!"

In all so-called intellectual efforts Darwin maintained that the difference, apart from fools, lay chiefly in zeal and hard work. What he meant by zeal we may infer from his observing that "there is nothing for style like a man's dander being put up." That is what he meant by gusto; even though his works were to be published anonymously he could put hard work into them, but not the zeal. Pride of achievement was zeal for him. He must write books that would be read. The idea of one of his books falling flat was more than distasteful—he could get so angry at himself because he could not write easily that the mere act of getting angry put his "dander" up, and thereby released some adrenalin into his blood, enabling him to beat his words into submission. That was good psychology.

On two different occasions Darwin ventured, "as

an old hackneyed author," to offer advice to young naturalists who were presumptive authors. I do not find this advice in books devoted to the technique of writing, but it is first-class advice and as sound and as applicable to-day as when written seventy-five years ago.

He had found it a good plan, he wrote, when he could not get a difficult discussion in pleasing form, to fancy someone coming into the room and asking him what he was doing; and then to try to explain to the imaginary person what it was all about; he sometimes tried this plan on Mrs. Darwin. He also found it good to read his manuscript aloud. Then he added this bit of advice: "Strike out every word which is not quite necessary to the current subject and which could not interest a stranger. I constantly asked myself, would a stranger care for this? and struck out or left in accordingly. I think too much pains cannot be taken in making the style transparently clear and throwing eloquence to the dogs."

He wrote the young gardener who went to India, that a paper he had submitted to him would have been better if written more simply and less elaborated—"more like your letters. It is a golden rule always to use, if possible, a short old Saxon word. Such a sentence as 'so purely dependent is the incipient plant on the specific morphological tendency' does not sound to my ears like good mother-English—it wants translating. . . . I go on the plan of thinking every single word which can be omitted without actual loss of sense as a decided gain." Nor

is he to despair about his style, he tells the gardener, although it is a little too ambitious. As for himself, he never studies style—he merely tries to get the subject as clearly as he can in his own head and then express it in the commonest language he can find. Even with the best of English writers, writing is slow work!

He finally warns the young man that for the present at least he is to be very sparing of introducing theory into his papers. Theory must guide his observations, but until his reputation is established he must publish theories sparingly, otherwise people would doubt his observations! On the other hand, Darwin had very little patience with naturalists of standing who withheld their theories because of fear and who were “as timid as young ladies should be, about their scientific reputation.”

It was in keeping with Darwin’s character that he had no quarrel with an honest reviewer who, after reading his work, felt impelled to attack it boldly and fearlessly; he would be much more pleased to be well attacked than to be handled in the “namby-pamby, old-woman style” of a certain cautious Oxford professor. He even became enthusiastic over a “prodigy” of a review which opposed him—a prodigy because it was “*perfectly* fair and just,” something he had “never expected” to find. But he could not help but chuckle on hearing from Murray that all the attacks on his book did not seem to injure its sale—and that would “make poor old Sedgwick groan.”

Sedgwick, it will be recalled, was his old master of

geology. His review of the *Origin* in the *Spectator* was characteristic of a category of reviews. It expressed hatred of Darwin's theory because Darwin had not come to it by the *inductive* track. That worried Darwin, and caused him to ask himself whether he understood how to reason scientifically. He was relieved to learn that John Stuart Mill thought his reasoning strictly logical. Sedgwick's trick was a common one. Prejudiced against Darwin's theory and unable to answer his arguments, he would dispose of it bodily by such a commonplace as: "This is not a Baconian induction."

At the close of his life Darwin expressed joy at having avoided all controversy with his critics and reviewers. He had followed Lyell's advice to keep out of controversies—they did no good and lost time and temper. His consolation was that he had worked as hard and as well as he could, and no man could do more. It was also in keeping with his character that he should have expressed the opinion that though he had often been grossly misrepresented, bitterly opposed, and ridiculed, his reviewers were, on the whole, honest, and had acted in good faith.

Possibly the finest tribute ever paid to Darwin as a writer was Geikie's characterization of his little article "Geology" in *A Manual of Scientific Enquiry* issued by the British Admiralty. After speaking of its great breadth of view, remarkable insight, and interesting and sympathetic treatment, Geikie added this significant sentence: "The author at once puts his readers into harmony with him." To which I

should like to add one sentence from the article itself: "No one can expect to solve the many difficulties which will be encountered, and which for a long time will remain to perplex geologists; *but a ray of light will occasionally be his reward, and the reward is ample.*"

Darwin also took great interest in the illustrations of his books, some being made by professional artists and some by his children, especially George. On receiving a drawing from one of his daughters-in-law he wrote back: "Michael Angelo is nothing to it."

Darwin's relations with his publisher Murray were probably not unique, but they were noteworthy. Murray, it seems, offered to publish Darwin's great work on handsome terms before he had seen the manuscript. Darwin accepted, but on the condition that Murray would have full power to retract. While Darwin thought that Murray would not lose, he could not help but exclaim: "God help him if he tries to read it!" On the arrival of the first copy, Darwin wrote Murray that he was infinitely proud and pleased at the appearance of his child, but he wanted to know if Murray had not been entirely too generous about the "scandalously heavy corrections" and suggested sharing their cost, as he had had no business to send such badly composed manuscript to the printers.

Murray accepted another book of Darwin's for publication before he had seen it. It turned out to be so large that Darwin feared it could never pay; if Murray did not want to publish it Darwin would

not hold him to the contract; "it would vex me all my life if I led you to heavy loss."

Murray's "loss" on Darwin may be inferred from the fact that the first edition of the *Origin* was sold out on the day of publication. This got to be almost a habit with Darwin's books. The royalties for the first and second editions of the *Origin* amounted to more than £800. For the second edition of his *Descent of Man* he received £1,470—which for a scientific book in 1874 was doing very well. His royalties formed an insignificant part of his income, but he took pride in them because they were proof that he had won his fight—written a book which would be read.

Darwin triumphed over his early shortcomings in writing his mother tongue. There was nothing fortuitous about his success as an author—nothing was left to chance. Nor did it spring from any innate talent to write; it was "dogged as" did it. His curiosity had led him far afield; he would bring home what he found and publish it for the benefit of those who had not had his opportunities to gratify their curiosity. But merely to publish was not enough—he must write what would be read. What he wrote was read—and men were moved, even as he himself had been moved.

CHAPTER XIV

HE DID NOT PROFESS CHRISTIANITY: HE LIVED A CHRISTLIKE LIFE

Let each man hope and believe what he can.—DARWIN.

I HAVE been called to account for saying in my *Why We Behave Like Human Beings* that Darwin died as he had lived, a Christian gentleman. It did not occur to me that my statement could be misconstrued. I knew that Darwin made no "profession" of Christianity. What I meant to say was that his life was Christlike, was what a Christian's life is supposed to be and so seldom is. In so far as a "Christian" life means one of service to one's fellow men, of taking thought for the beam in one's own eye rather than looking out for the mote in someone else's, of following the principle of the Golden Rule in one's actual deeds, in all that makes for nobility of character within and without the house, in work and play, in bodily act and in spoken word, and for seven days in the week—in all that, Darwin's life was that of a Christian gentleman. From the point of view of the modern fundamentalist, Darwin was not a Christian at all. He did not hate the things they hate, he had none of their blind intolerance, none of their so-called veneration for Words, Books, Bibles, Creeds, Doctrines, and other fetishes.

Darwin was primarily and always a scientist. Therein we have a clue to his attitude toward certain commonly accepted religious beliefs, as well as toward life in general. Born without knowledge, he became an agnostic. He did not presume to say there was no God, nor did he ever deny the existence of God; he simply could not accept the prevailing belief in the superman invented by men who felt impelled to account for the world in which they found themselves and to whom "creation" was unthinkable without a "Creator." He was curious about such concepts as soul, immortality, etc., as he was about other concepts more immediately at hand; but he could not explore them as he could other things, and about things which he could not *know* he was an "agnostic." Nor could he find, as do many scientists to-day and as philosophers throughout time have found, satisfaction in mere speculation which did not logically follow from observation. Not being obsessed with the necessity of finding a soul, for example, he could not endow either the matter of atoms or the matter of the universe with souls. Intent as he was on knowing nature, he found little time for speculating about the supernatural.

It was inevitable that Darwin's youthful attitudes and beliefs in religious matters should have become overlaid with more mature habits of thought, that his religious beliefs should evolve, and in evolving should greatly change. He began as a theist; in the process of the evolution of his ideas he did not become an atheist, but an agnostic.

Darwin himself was loth to speak of his religion. "What my own views may be," he wrote a few years before he died, "is of no consequence to any one but myself." He felt that his religion, like his family life, was his own business, a private matter about which an outsider might inquire but into which no one might intrude. But no account of the evolution of his personality would be complete without noting the changes which took place in his beliefs. His autobiography and letters supply the necessary information.

Up to the time of the voyage of the *Beagle* Darwin's views were orthodox: he was even "heartily laughed at by the officers for quoting the Bible as an unanswerable authority on some point of morality." We must remember that he had graduated from Cambridge University with the idea of taking Holy Orders, and that though his mother was a Unitarian, the Darwin family was Church of England (and their idea of Unitarianism is gathered from a remark of Grandfather Erasmus, who called it "a feather bed to catch a falling Christian").

In other words, up to 1836, so far as his early training was concerned, there was no reason why Darwin should have questioned any of his religious tenets. Nor, to anticipate, was there anything in his wife's religion which could suggest that he change his views; we may infer rather that such change as came over him caused her much anxiety. Thus in the very year which saw the light of the *Origin of Species*, we find her trying to persuade a relative to refuse a

neighbor's invitation which involved the use of a carriage on Sunday; she also questioned whether it was right to embroider, knit, or play patience on that day. And on the publication of the *Descent of Man* she wrote her daughter that she thought it would be very "interesting" but that she would "dislike it very much as again putting God further off." Note the "again."

The years 1836 to 1839 marked a definite change in Darwin's beliefs. He had come to see "that the Old Testament was no more to be trusted than the sacred books of the Hindus. The question then continually rose before my mind and would not be banished—is it credible that if God were now to make a revelation to the Hindus, he would permit it to be connected with the belief in Vishnu, Siva, etc., as Christianity is connected with the Old Testament? This appeared to me utterly incredible."

During that period Darwin also reflected much on the miracles set forth in the New Testament. At first he accepted them naïvely, but the more he studied nature the more incredible they became—though he could understand how belief in miracles arose, because men were then "incomprehensibly ignorant and credulous." Darwin read the Gospels carefully and critically; as a result, he "gradually came to disbelieve in Christianity as a divine revelation."

But this disbelief was not come to readily; he even spent time daydreaming of the discovery of letters or manuscripts in the ruins of Pompeii which would confirm what was in the Gospels. But he could not

even invent evidence which would convince him: "Thus disbelief crept over me at a very slow rate, but was at last complete. The rate was so slow that I felt no distress." And with this Darwin may be said to have definitely broken with the Christian "faith" to the extent that the faith was founded on "revelation" or other supernatural factors. Nor did he change his disbelief. Only three years before he died he wrote a German student who had insisted on getting his religious views: "Science has nothing to do with Christ, except in so far as the habit of scientific research makes a man cautious in admitting evidence. For myself, I do not believe that there ever has been any revelation. As for a future life, every man must judge for himself between conflicting vague probabilities."

The next great change in Darwin's religious beliefs was of slower growth. It came about through his being forced to question the arguments from Design in Nature that he had learned in Paley. Once Darwin had discovered the law of natural selection, Paley's arguments failed; he could find no more "design" in the variability of organic beings than in the course which the wind blows. Yet here again the change in his beliefs came only after much meditation had forced him to alter his opinions.

He started out with a firm conviction of the existence of God and of an immortal soul. When emotionally aroused in the Brazilian forest, he was convinced that there was more in Man than the mere breath of his body; he felt that that "inward convic-

tion" was in itself proof of the existence of an immortal soul. But when he saw that inward convictions have no weight as evidence of what really exists, he revised this opinion. But even up to the time of writing the *Origin of Species* he felt that he had to look for a First Cause with an intelligent mind analogous to Man's: that is, he was a theist. But more and more he came to feel that "the mystery of the beginning of all things is insoluble by us"; his conviction that there must be a First Cause weakened.

Shortly after the publication of the *Origin*, Darwin wrote to Gray:

One word more on "designed laws" and "undesigned results." I see a bird which I want for food, take my gun and kill it, I do this *designedly*. An innocent and good man stands under a tree and is killed by a flash of lightning. Do you believe (and I really should like to hear) that God *designedly* killed this man? Many or most persons do believe this; I can't and don't. If you believe so, do you believe that when a swallow snaps up a gnat that God designed that that particular swallow should snap up that particular gnat at that particular instant? I believe that the man and the gnat are in the same predicament. If the death of neither man nor gnat are designed, I see no good reason to believe that their first birth or production should be necessarily designed.

In another letter to Gray, Darwin declared that if anything had been designed certainly Man must be, but he could not admit that Man's rudimentary mammæ were designed: "If I was to say I believed this, I should believe it in the same incredible manner as the orthodox believe the Trinity in Unity. You say that you are in a haze; I am in thick mud; the orthodox would say in fetid, abominable mud."

On different occasions Darwin expressed his feeling that there seemed to be so much misery in the world that he could not persuade himself that a beneficent and omnipotent God had designedly created it. "What a book a devil's chaplain might write on the clumsy, wasteful, blundering, low, and horribly cruel, works of nature." And yet he could not satisfy himself that everything was due to Chance. The subject was too profound: "A dog might as well speculate on the mind of Newton. Let each man hope and believe what he can." A few years later he expressed the same idea to Hooker: "It is foolish to touch such subjects."

Darwin's comment on Herschel's criticism of the *Origin*, that it had not stated the higher law of providential arrangement, is as valid to-day as when written: astronomers do not state that God directs the course of each comet and planet; why, then, should he state that each variety of living beings had been providentially arranged? Such a view would make natural selection superfluous and take the whole case of the appearance of new species out of the range of science. It reminded him of the Spaniard's comment when Darwin told him he was trying to find out how the Cordilleras were formed: it is useless and impious to try, God made them.

In a letter to Hooker in 1870 Darwin agrees that all speculation about "preordination" is an idle waste of time—"but how difficult it is not to speculate. . . . I cannot look at the universe as the result of blind chance, yet I can see no evidence of

beneficent design, or indeed a design of any kind in the details." "The whole subject is beyond the scope of man's intellect" was his conclusion in another letter; "but man can do his duty."

That there must be a soul because of the "convictions" of Man's mind was no valid argument to Darwin, holding as he did that Man's "mind" had been developed from the mind of lower animals. Would anyone, he asked, trust in the "convictions" of a monkey's mind?

Darwin's answer to the "immortality" argument was equally scientific. Life itself, it was argued, is a supernatural phenomenon, and every living being (or at least Man) contains some mysterious supernatural or vital force. As this force (that is, life itself) cannot have evolved but is of supernatural origin, life must be immortal. Darwin recalled that, within his own lifetime, substances found in living plants or animals had been produced without the aid of a vital or supernatural force. There was yet no evidence of a living being having been developed from inorganic matter, yet so firmly did he hold to the law of continuity that he could not avoid believing that the evolution of living beings from inorganic matter would some day be proved, in which case vital phenomena would be brought under some general law of Nature.

Likewise, no one had proved death to be inevitable, but the evidence that death was inevitable was overwhelmingly strong. Evolution itself depended on successive generations, which implied death; "it

seems to me in the highest degree improbable that man should cease to follow the general law of evolution, and this would follow if he were to be immortal."

Nor did he trouble much about the question of the eternity of matter; it was among the "insoluble questions." The claim that the *Origin* "explained the universe," as one critic implied, was a "most monstrous exaggeration." The more he thought, the more he felt the hopeless immensity of Man's ignorance. "The whole question seems to me insoluble." And as to whether the existence of a "conscious God" could be proved from the existence of the so-called laws of Nature, he could not see his way clearly; but it was a "perplexing question", on which he had thought much.

When Darwin could see his way clearly, he did not hesitate to say so. He had investigated the arguments usually adduced for certain theistic and religious beliefs: the arguments had not convinced him, certain definite "beliefs" had become "unbeliefs." Having freed himself of his youthful beliefs in supernatural beings, agencies, and forces, there was nothing to hinder him from exploring Nature herself. Thus he had become a child again, with childish curiosity, and without preconceived notions and beliefs. He would explore Nature and get some notions and beliefs. That became his one great ambition, to which he devoted his life.

Thus in a broad sense it may be said that devotion to science was his religion, and that in behalf of its ideals he was a zealous and faithful soldier. He

definitely enlisted under that banner at the age of twenty-four.

He was literally absorbed in seeking truth for truth's sake. This so filled his life that there was no room in it for any other growth. He did not have to fight with envy, malice, arrogance, irritability, etc.; such faults simply did not exist in him. Cautious, patient, candid, keen for every detail, always fresh for a new clue, hearty, good-natured, with a keen sense of humor, amusing, brilliant, fascinating, yet always refined and sensitive to anything in questionable taste, he was first and foremost and always a Christian gentleman in the finest sense of the term.

We have seen how kind he was, how he genuinely delighted to help anyone needing help, how he could kindle enthusiasm in those who had not yet learned to walk in science, the joy he took in congratulating friends on their success, his eternal search for facts and opinions from every quarter, and the infinite variety and accuracy of his knowledge. As a result, he could plod through endless masses of detail, he could grasp world-transforming truth. He did not bother himself about any other religion, nor did he go out of his way to attack the clergy of any other religion. Yet the Christian clergy attacked him. One abused him "in language sufficiently plain and emphatic to have satisfied any reasonable man," and "vainly searched the English language to find terms to express his contempt for me and all Darwinians."

That was not Darwin's idea of religion or of playing the game. He was never an attacker or destroyer;

he became more and more an inventor, a creator. He so loved knowledge and light that he could spend his life in finding them; that left him no time to waste in hating darkness or abusing ignorance. If one speaks of Darwin as a destroyer of beliefs, one must also speak of Columbus as a destroyer of beliefs, and of Ben Franklin and his kite as a destroyer of beliefs. Columbus brought the New World to the Old, and Franklin brought electricity down to earth. Darwin was no more a destroyer than is the husbandman who drains a swamp and prepares the ground for crops. To be sure, one might hold that the swamp was quite as valuable as the plowed field, that Franklin and Columbus in overturning certain beliefs set up nothing more important instead. One cannot quarrel with such a point of view, nor can one meet it. The hypothesis of natural selection is a tool by which men can manipulate the known world of living beings and push forward their inquiries into the as yet unexplored world of living beings. It is an invention, comparable to that of the compass or the bacterial theory of disease. Many sail without a compass, and die because it is the will of God. That does not lessen the value of the compass or the bacterial theory of disease for those who can make them work for human ends.

The theory of evolution did not destroy; it restored. Darwin himself would have turned his back on that theory if one single fact could have been produced in favor of the hypothesis of immutability, special creation, or supernatural agency. No such

fact was forthcoming in his time, nor has any such fact been brought to light since. It still stands as a working hypothesis, the best tool we have.

Therein has Darwin's religion justified itself. It manifested itself in zeal—zeal to find out more, zeal to know more, zeal to do more. It was not kept in a watertight compartment, to be exhibited only on special occasions or on certain days, or to be employed only in certain occupations or pursuits. Again and again it led to acts which can only be characterized as humane. He had a sense of responsibility to the society in which he found himself—Down House, the parish, the county, the state, the world at large of human beings. That was the world he served; he served it so whole-heartedly that he had no energy for supernatural worlds or devotions to supernatural beings.

But he could be "struck with infinite admiration" for Pasteur's work and rejoice to have lived to see Koch's researches, one of the greatest triumphs of science, bear fruit, and he thought that everyone in the future would be astonished at the ingratitude shown to such benefactors of mankind as Pasteur, Koch, and Virchow. He honors and shall always honor everyone who advances the noble science of physiology.

Yet this man, so tender-hearted that he hated to kill a pigeon in the interests of science, realized the absolute necessity of vivisection in advancing physiology, and his method of "honouring" physiologists was not merely with words; he was ready to go down

into his pocket to help a Science Defence Association which was to become charged with the duty of protecting physiologists from the clamor of sentimental fanatics. He could not accept its presidency because his wife felt that the anxiety would tell heavily on his health, but he would "gladly subscribe fifty or a hundred pounds."

And in countless other respects he showed his characteristic broad-mindedness and sound sense. Merely writing against the bigots about vivisection was as "hopeless as stemming a torrent with a reed." Bigoted writing against evolution had not stopped the spread in its belief. To Haeckel, who made natural selection a religion and fought for it with the zeal of a bigot, Darwin wrote that such zeal would excite anger, and that anger would so completely blind everyone that his arguments could not influence those already opposed. "I do not at all like that you towards whom I feel so much friendship, should unnecessarily make enemies, and there is pain and vexation enough in the world without any more being caused."

And never did Darwin's character shine more clearly than during the long and cruel controversy that followed the publication of his great work. His views were hooted, his character was assailed. Through it all he went the even tenor of his way, kind, tranquil, serene. Nothing seemed to warp or embitter him. He was literally powerful in his humility and mighty in his gentleness. Thus the *Pall Mall Gazette* felt it "must call attention to the

rare and noble calmness with which he expounds his own views, undisturbed by the heats of polemical agitation which those views have excited, and persistently refusing to retort on his antagonists by ridicule, by indignation, or by contempt." And in another issue it declared that "nowhere has the author a word that could wound the most sensitive self-love of an antagonist; nowhere does he, in text or note, expose the fallacies and mistakes of brother investigators. . . . but while abstaining from impertinent censure, he is lavish in acknowledging the smallest debts he may owe; and his book will make many men happy."

The law of Nature propounded by Darwin was revolutionary in character, but his character was such as to impel respectful attention to it—and in an incredibly short space of time—where it might not have been forthcoming otherwise. Even the Duke of Argyll could oppose Darwin, yet feel honored to be one of his pall-bearers; and, in replying to Romanes' attack on the Duke's views, wish that "Darwin's disciples would imitate a little of the dignified reticence of their master. He walks with a patient and a stately step along the paths of conscientious observation."

Science was Darwin's religion, but it was not to be worshiped, nor was any dogma of science to be venerated. What Darwin valued rather was the "grand onward rush of science—enough to console us for our many errors and for our efforts being overlaid and forgotten in the mass of new facts and new

views which are daily turning up." It was through science that the truth was to be discovered which would set us free: that was Darwin's religion. To believe that mankind would progress to such a pitch that we should look back at ourselves as mere barbarians, was his faith in his religion; and in that faith he found "infinite satisfaction."

As though by intuition he seemed to recognize insuperable difficulties, and to have the good sense to follow the adage of his day: he looked them squarely in the face—and passed on. He dealt with concrete life as he found it. He left questions of Creators, Causes, and Designs to theologians and metaphysicians. Darwin was a scientist. But he was no atheist, or he could not have closed his *Origin of Species* with these words:

When I view all beings not as special creations, but as the lineal descendants of some few beings which lived long before the first bed of the Cambrian system was deposited, they seem to me to become ennobled. . . . There is grandeur in this view of life, with its several powers, having been originally breathed by the Creator into a few forms or into one; and that, whilst this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning endless forms most beautiful and most wonderful have been, and are being evolved.

And so, somehow, we feel that we must agree with the old lady who, on being told that Darwin would go to hell for his wicked doctrines, exclaimed that God Almighty could not afford to do without so good a man!

CHAPTER XV

HE WAS A GREAT BENEFACTOR OF MANKIND

I believe that I have acted rightly in steadily following, and devoting my life to Science. I feel no remorse from having committed any great sin, but have often and often regretted that I have not done more direct good to my fellow creatures.

DARWIN.

IT WAS in keeping with Darwin's habits of well-doing that on his last visit to London he should stagger three hundred yards from the house of a friend because he did not want to give trouble to a butler. The friend was out. On the doorstep Darwin was seized with an attack. The butler, noticing his condition, asked him to come in, but Darwin said he preferred to go home as he did not want to give any trouble; and he staggered off on foot to find a cab.

Three months later, March 7, 1882, he took his last turn on his favorite Sand Walk. On April 18th he fainted, and was revived with difficulty. The next day he died, in his seventy-fourth year, and he was "not the least afraid to die."

It was the family's desire that he should be buried at Down House, but the House of Commons moved to have him buried in Westminster Abbey, and there, in Britain's Valhalla, the funeral took place on April 26, 1882, with the following pall-bearers: Sir John

Lubbock, Huxley, James Russell Lowell (American Minister), Wallace, the Duke of Devonshire, Canon Farrar, Hooker, William Spottiswoode (President of the Royal Society), the Earl of Derby, the Duke of Argyll. Present at the funeral were representatives of France, Germany, Italy, Spain, and Russia; and of the universities and many learned societies. The grave is near that of the other Christ's College, Cambridge, benefactor of mankind, Sir Isaac Newton. Poorer for Darwin's death, the entire civilized world joined in mourning its loss. Even those who loved him best were hardly prepared for the manifestation of affection in which he had come to be held throughout the world.

As *The Times* said of him, he thought, and his thoughts passed into the substance of the facts of the universe. And grass plots, flowers, human gestures, and all the doings and tendencies of nature, build his monument and record his exploits. The Abbey's orators and ministers have swayed nations, but not one of them ever wielded over men and intelligence so complete a power as did Darwin.

In his desire to find someone wiser, in his belief in the sovereignty of reason, in his ready humor, and in his sympathetic interest in all the ways and works of men, Darwin has been compared to Socrates; but Socrates turned away from the problems of Nature as insoluble, Darwin devoted his life to their solution. Countrymen of Socrates had not hesitated to attack these problems, nor had others from Greeks to Darwin, and shrewd guesses had been made about the

world of living beings, but at best they had only guessed what Darwin proved.

Who, then, was Darwin? How did his solution of the problem of Nature benefit mankind? Darwin himself attempted an answer to these two questions: to the first, in his autobiography; to the second, in his hundred and more books and papers.

But why did he love science—rather than medicine or theology? Why was he so industrious in observing and collecting facts in the field of Nature—rather than, for example, in the field of Grecian archæology or Biblical history? And why was he superior to the common run of men in noticing things which easily escape attention? Innate talents, inherited bents?

From Darwin's analysis of himself we might infer that he naturally loved science, had an innate bent for collecting facts in the field of Nature, and was a born observer. But no known law of heredity helps us understand how it was that he could win such success that it could be said of him, as it can of few men, that he enlarged science, changed it, and revolutionized the basal concept of the entire world of living organisms, whereas his brother Erasmus left no mark on the sands of time but the loving words of his brother in lamenting the death of "poor old Ras." No known law of heredity enables us to understand the astonishingly different growths of these two chips from the same old family block.

Human personalities are not so simple; otherwise we should not be eternally encountering such divergences in culture in general and such dissimilarities in

families as could produce Charles, the colossus, and Erasmus, the nonentity. Those who would account for differences in cultures and in personalities as due to physical inheritance or innate structure must prove that cultural or personality trait and innate physical structure are necessarily connected. Such proof has not yet been produced, and in the writer's opinion never will be.

Erasmus Darwin, for example, never walked with Henslow; no voyage of the *Beagle* knocked at his door. Charles did walk with Henslow; he did make the voyage of the *Beagle*.

The outstanding phenomenon of Darwin's life is achievement. What didn't he do!—as explorer, observer, investigator, writer, husband, father, citizen. He was the friend of all the world. And he was ambitious. But ambition prompted by hatred or by mere passion of possession cannot go so far as Darwin's ambition carried him. Fear, of course, leads nowhere at all. Hatred leads to destruction. Love of possession finds its goal in mere possession rather than in creation.

Is it not significant that the Shrewsbury classical school left Darwin cold; that the Edinburgh medical school disgusted him; and that the Cambridge theological school drove him into a sporting set? Why was this? Why do our schools to-day continue the crime of turning out young men and young women cold or stranded?

Neither Shrewsbury, Edinburgh, nor Cambridge tried to find out what Darwin liked or wanted to do,

nor offered him anything to gratify his tastes or appeal to his ambition. Their prescribed courses touched no trigger in his make-up to rouse him to action.

He was in no respect superhuman, he was in every respect human; he could move forward only when impelled, and could accomplish what he did only because the impelling force was love.

A mother is always an influence, but Darwin's mother became the dominating influence in his life because by word and deed she stimulated a normal innate curiosity to explore, to take definite bents. She had the sweetness, beauty, and brains which would appeal to a son; her curiosity had been aroused to the point of fascination by the writings of her father-in-law. Her own curiosity as to the origin of things easily hitched up with her son's curiosity and gave direction and significance to his inquiring disposition. Darwin's love of science came first among the qualities which made him a great creator; but without the interest aroused in him by his mother's wish to know, we should be left without answer to the question: why did Darwin love science and why did he follow it so loyally?

To know the hows and whys of things, to discover the relationships of things in time and space (science, in short, and natural science at that), to wrest from flowers and birds and shells and stones the very secrets of their nature—to know all these things had at an early age become the great passion of his life. It was to take the place of religion, it was to become his religion. He could devote himself to it loyally,

whole-heartedly, and with all the eagerness and strength that he could put into it, because through it he could cherish his love for and his memory of his mother and fulfil his father's wish that he accomplish something worthy of the family.

Darwin had a particular kind of mother; a father who was ambitious for his son's success; a Grant and oystermen at Edinburgh; a Henslow at Cambridge; a *Wonders of the World* and a *Personal Narrative*; and an Uncle Jos "when a feller needed a friend." Mrs. Henslow had looked sad and Henslow had recommended Darwin. The captain changed his opinion about Darwin's nose. Darwin sailed round the globe on the *Beagle*. His father gave in and Charles was allowed to follow the path that had by now become his fate. And how he followed it!

But two factors must yet be taken into account: he did not have to worry about "bread and cheese"; he married the right girl. Without economic independence and without Emma Wedgwood, Darwin's career might have been entirely different.

Add it all up: and we have as lovable, genial, and humane a human being as ever lived, an "incorporated ideal of a man of science," a benefactor of mankind, a well-doer in that the life he lived must remain a pattern for all time, a well-doer in that his work restored the world of Nature to Man, its lord and master; accomplishments which entitle him to be ranked among the immortals of human history, second to none as a human benefactor.

During the sixty-eight years since the publication

of the *Origin of Species* every science has been revolutionized, and Man has changed his attitude toward himself and the world in which he lives. This change is due to increased knowledge, and this in turn is due primarily to the fact that Darwin brought men and all living organisms within the range of human observation. He made curiosity respectable and investigation the fashion.

Our ancestors were curious and were not afraid to investigate, but in time curiosity became the prerogative of the few, who claimed they had talked with God. In His name they demanded blind acceptance of their creed and denied the right of further inquiry. Into such a society Darwin was born and in such he grew up. Sedgwick, professor of geology at Cambridge, Buckland, professor of geology at Oxford, and Henslow himself, were clergymen of the Church of England. That Church had authority; not the authority of the Spanish Inquisition, but the authority of immense prestige and of social, economic, and political power. That Church knew all that need be known about the world of matter which had been handed down to Man, as it were on a platter. He could take it or leave it; but what he dared not do was to exercise his inherent right to question the platter or the world as it was presented to him on that platter.

Besides, it was and is so calmly comforting to believe that we are all children of God, divinely created in His image! Why *question* such a belief? But Darwin had seen degraded *savages*—naked, without

arts, and living like wild animals on what they could catch. "Such were our ancestors." Should we feel much shame "if forced to acknowledge that the blood of some more humble creature" flows in our veins? "For my own part, I would as soon be descended from that heroic little monkey, who braved his dreaded enemy in order to save the life of his keeper; or from that old baboon, who, descending from the mountains, carried away in triumph his young comrade from a crowd of astonished dogs—as from a savage who delights to torture his enemies, offers up bloody sacrifices, practises infanticide without remorse, treats his wives like slaves, knows no decency, and is haunted by the grossest superstitions."

We who to-day naïvely accept evolution even as Darwin's generation accepted special Creation and L'vine origins, cannot easily realize how completely natural science in 1859 was sunk in stupid detail. There were no problems to be solved, only curios to be collected. As Weismann tells us from personal experience, the students of the fifties had no idea that a theory of evolution had ever been put forward; no one ever spoke of it to them; it was never mentioned in a lecture. "It seemed as if all the teachers in our universities had drunk of the waters of Lethe."

"The waters of Lethe"—stagnation, death. Then came Darwin, with a weapon to break down prejudice hoary with age and replace a theory which had shed so little light on Man's nature or his place in Nature that Man himself was as much in the dark as he was

in the days of Moses. In 1859 more was known about Man and living things than was known in the days of Moses, but Man himself was just as powerless in the control of his facts. He could not make them work; he could not arrange them in such order that he could draw inferences from them and thereby re-create the past and predict the future. He had to fit his facts to the cast-iron mold; and that was deadening to the facts. Darwin shattered that mold and restored the facts to life.

Darwin was a creator—he re-created life. He was a restorer—he restored human destiny to human hands. He was a builder—he laid the foundation on which Man can build his heaven here and now. But benefactor as he was, mankind will not have reaped the utmost benefit from his efforts until it agrees with him that Peace on Earth, Good-will to Men is “the most perfect description of happiness that words can give;” and seeks that happiness, even as did he, by living a life of peace and of good-will to men.

THE END

APPENDIX I

OUTLINE OF CHARLES DARWIN'S LIFE*

- 1809 Feb. 12th: Born at Shrewsbury.
1817 Death of his mother.
1818 Went to Shrewsbury School.
1825 Left Shrewsbury School.
1826 Oct.: Went to Edinburgh University. Read two papers before the Plinian Society of Edinburgh "at the close of 1826 or early in 1827."
1827 Entered at Christ's College, Cambridge.
1828 Began residence at Cambridge.
1831 Jan.: Passed his examination for B.A., and kept the two following terms.
Aug.: Geological tour with Sedgwick.
Sept. 11th: Went to Plymouth to see the *Beagle*.
Oct. 2d: "Took leave of my home."
Dec. 27th: "Sailed from England on our circumnavigation."
1832 Jan. 16th: "First landed on a tropical shore" [Santiago].
1833 Dec. 6th: "Sailed for last time from Rio Plata."
1834 June 10th: "Sailed for last time from Tierra del Fuego."
1835 Sept. 5th: "Sailed from west shores of South America."
Nov. 16th: Letters to Professor Henslow, read at a meeting of the Cambridge Philosophical Society.
Nov. 18th: Paper read before the Geological Society on Notes made during a Survey of the East and West Coasts of South America in years 1832-35.
1836 May 31st: Anchored at the Cape of Good Hope.
Oct. 2d: Anchored at Falmouth.
Oct. 4th: Reached Shrewsbury after an absence of five years and two days.

*From *More Letters of Charles Darwin*, edited by Francis Darwin.

- 1836 Dec. 13th: Went to live at Cambridge.
- 1837 Jan. 4th: Paper on Recent Elevation in Chili read.
 Mar. 13th: Settled at 36 Great Marlborough Street.
 Mar. 14th: Paper on *Rhea* read.
 May: Read papers on Coral Formation, and on the Pampas to the Geological Society.
 July: Opened first notebook on Transmutation of Species.
 March 13th to Nov.: Occupied with his Journal.
 Oct. and Nov.: Preparing the scheme for the Zoology of the Voyage of the *Beagle*.
 Working at Geology of South America.
 Nov. 1st: Read the paper on Earthworms before the Geological Society.
- 1838 Worked at the Geology of South America and Zoology of Voyage. "Some little species theory."
 March 7th: Read paper on the Connexion of certain Volcanic Phenomena and on the Formation of Mountain Chains, to the Geological Society.
 May: Health began to break down.
 June 23rd: Started for Glen Roy. The paper on Glen Roy was written in August and September.
 Oct. 5th: Began Coral paper.
 Nov. 11th: Engaged to be married to his cousin, Emma Wedgwood.
 Dec. 31st: "Entered 12 Upper Gower Street."
- 1839 Jan. 29th: Married at Maer.
 Feb. and March: Some work on Corals and on Species Theory.
 March (part) and April: Working at Coral paper.
 Papers on a Rock seen on an Iceberg, and on the Parallel Roads of Glen Roy.
 Published *Journal and Remarks*, being Vol. III of the *Narrative of the Surveying Voyages of H.M.S. Adventure and Beagle, etc.*
 For the rest of the year, Corals and Zoology of the Voyage.
 Publication of the *Zoology of the Voyage of H.M.S. Beagle*, Part II (Mammalia).
- 1840 Worked at Corals and the Zoology of the Voyage.
 Contributed Geological introduction to Part I of the *Zoology of the Voyage*.

- 1841 Publication of Part III of the *Zoology of the Voyage* (Birds).
 Read paper on Boulders and Glacial Deposits of South America, to the Geological Society.
 Published paper on a remarkable bar of Sandstone off Pernambuco, on the coast of Brazil.
 Publication of Part IV of *Zoology of the Voyage* (Fish).
- 1842 May 6th: Last proof of the Coral book corrected.
 June: Examined Glacier action in Wales.
 "Wrote pencil sketch of my Species Theory."
 July: Wrote paper on Glaciers of Caernarvonshire.
 Oct.: Began his book on Volcanic Islands.
- 1843 Working at *Volcanic Islands* and "some Species work."
- 1844 Feb. 13th: Finished *Volcanic Islands*.
 July to Sept.: Wrote an enlarged version of Species Theory.
 Papers on *Sagitta*, and on *Planaria*.
 July 27th: Began his book on the Geology of South America.
- 1845 Paper on the Analogy of the Structure of Volcanic Rocks with that of Glaciers. *Proc. R. Soc. Edin.*
 April 25th to Aug. 25th: Working at second edition of *Naturalist's Voyage*.
- 1846 Oct. 1st: Finished last proof of *Geological Observations on South America*.
 Papers on Atlantic Dust, and on Geology of Falkland Islands, communicated to the Geological Society.
 Paper on *Arthrobalanus*.
- 1847 Working at Cirripedes.
 Review of Waterhouse's *Natural History of the Mammalia*.
- 1848 Mar. 20th: Finished Scientific Instructions in Geology for the Admiralty Manual.
 Working at Cirripedes.
 Paper on Erratic Boulders.
- 1849 Health especially bad.
 Working at Cirripedes.
 March to June: Water-cure at Malvern.
- 1850 Working at Cirripedes.
 Published Monographs of Recent and Fossil Lepadidæ.
- 1852 Working at Cirripedes.

- 1853 Nov. 30th: "Royal Medal given to me."
- 1854 Published Monographs on Recent and on Fossil Balanidæ and Verrucidæ.
 Sept. 9th: Finished packing up all my Cirripedes. "Began sorting notes for Species Theory."
- 1855 March-April: Experiments on the effect of salt water on seeds.
 Papers on Icebergs and on Vitality of Seeds.
- 1856 May 14th: "Began, by Lyell's advice, writing Species Sketch."
 Dec. 16th: Finished Chap. III.
 Paper read to Linnæan Society, On Sea-water and the Germination of Seeds.
- 1857 Sept. 29th: Finished Chapters VII and VIII.
 Sept. 30th to Dec. 29th: Working on Hybridism.
 Paper on the Agency of Bees in the Fertilisation of Papilionaceous Flowers.
- 1858 March 9th: "Finished Instinct chapter."
 June 18th: Received Mr. Wallace's sketch of his evolutionary theory.
 July 1st: Joint paper of Darwin and Wallace read at the Linnæan Society.
 July 20th to July 27th: "Began Abstract of Species book," i. e., the *Origin of Species*, at Sandown, I. W.
 Paper on Bees and Fertilisation of Flowers.
- 1859 May 25th: Began proof sheets of the *Origin of Species*.
 Nov. 24th: Publication of the *Origin*: 1,250 copies printed.
 Oct. 2d to Dec. 9th: At the water-cure establishment, Ilkley, Yorkshire.
- 1860 Jan. 7th: Publication of Edit. II of *Origin* (3,000 copies).
 Jan. 9th: "Looking over MS. on Variation."
 Paper on the Fertilisation of British Orchids.
 July and again in Sept.: Made observations on *Drosera*.
 Paper on Moths and Flowers.
 Publication of *A Naturalist's Voyage*.
- 1861 Up to July at work on *Variation under Domestication*.
 April 30th: Publication of Edit. III of *Origin* (2,000 copies).
 July to the end of year, at work, on Orchids.
 Nov.: *Primula* paper read at Linnæan Society.
 Papers on *Pumilio* and on Fertilisation of *Vinca*.

- 1862 May 15th: Orchid book published.
Working at *Variation*.
Paper on *Catasetum* (Linnæan Society).
Contribution to Chapter III of Jenyns' Memoir of Henslow.
- 1863 Working at *Variation under Domestication*.
Papers on Yellow Rain, the Pampas, and on Cirripedes.
A review of Bates's paper on Mimetic Butterflies.
Severe illness to the end of year.
- 1864 Illness continued until April.
Paper on *Linum* published by the Linnæan Society.
May 25th: Paper on *Lythrum* finished.
Sept. 13th: Paper on Climbing Plants finished.
Work on *Variation under Domestication*.
Nov. 30th: Copley medal awarded to him.
- 1865 Jan. 1st: Continued at work on *Variation* until April 22d.
The work was interrupted by illness until late in the autumn.
Feb.: Read paper on Climbing Plants.
Dec. 25th: Began again on *Variation*.
- 1866 Continued work at *Variation under Domestication*.
March 1st to May 10th: At work on Edit. IV of the *Origin*.
Published June (1,250 copies).
Read paper on *Cytisus scoparius* to the Linnæan Society.
Dec. 22d: Began the last Chapter of *Variation under Domestication*.
- 1867 Nov. 15th: Finished revises of *Variation under Domestication*.
Dec.: Began papers on Illegitimate Unions of Dimorphic and Trimorphic Plants, and on *Primula*.
- 1868 Jan. 30th: Publication of *Variation under Domestication*.
Feb. 4th: Began work on *Man*.
Feb. 10th: New edition of *Variation under Domestication*.
Read papers on Illegitimate Unions of Dimorphic and Trimorphic Plants, and on *Verbascum*.
- 1869 Feb. 10th: "Finished fifth edition of *Origin*; has taken me forty-six days." Edit. V. published in May.
Working at the *Descent of Man*.

- 1869 Papers on the Fertilisation of Orchids, and on the Fertilisation of Winter-flowering Plants.
- 1870 Working at the *Descent of Man*.
Paper on the Pampas Woodpecker.
- 1871 Jan. 17th: Began the *Expression of the Emotions*.
Feb. 24th: *Descent of Man* published (2,500 copies).
April 27th: Finished the rough copy of *Expression*.
June 18th: Began Edit. VI of *Origin*.
Paper on the Fertilisation of *Leschenaultia*.
- 1872 Jan. 10th: Finished proofs of Edit. VI of the *Origin*, and "again rewriting *Expression*."
Aug. 22d: Finished last proofs of *Expression*.
Aug. 23d: Began working at *Drosera*.
Nov.: *Expression* published (7,000 copies, and 2,000 more printed at the end of the year).
Nov. 8th: "At Murray's sale 5,267 copies sold to London booksellers."
- 1873 Jan.: Correcting the Climbing Plants paper for publication as a book.
Feb. 3d: At work on *Cross-fertilisation*.
Feb. to Sept.: Contributions to *Nature*.
June 14th: "Began *Drosera* again."
Nov. 20th: Began *Descent of Man*, Edit. II.
- 1874 *Descent of Man*, Edit. II, in one volume, published (Preface dated September).
Coral Reefs, Edit. II, published.
April 1st: Began *Insectivorous Plants*.
Feb. to May: Contributed notes to *Nature*.
- 1875 July 2d: *Insectivorous Plants* published (3,000 copies); 2,700 copies sold immediately.
July 6th: "Correcting 2d edit. of *Variation under Domestication*." It was published in the autumn.
Sept. 1st (approximately): Began on *Cross and Self-Fertilisation*.
Nov.: Vivisection Commission.
- 1876 May 5th: "Finished MS., first time over, of *Cross and Self-Fertilisation*."
May-June: Correction of *Fertilisation of Orchids*, Edit. II.
Wrote his Autobiographical Sketch.
May and Nov.: Contributions to *Nature*.

- 1876 Aug. 18th: First proofs of *Cross and Self-Fertilisation*.
Nov. 10th: *Cross and Self-Fertilisation* published (1,500 copies).
- 1877 "All the early part of summer at work on *Different Forms of Flowers*.
July: Publication of *Different Forms of Flowers* (1,250 copies).
During the rest of the year at work on the bloom on leaves, movements of plants, "and a little on worms."
Nov.: LL.D. at Cambridge.
Second edition of *Fertilisation of Orchids* published.
Contributions to *Nature*, *Gardeners' Chronicle*, and *Mind*.
- 1878 The whole year at work on movements of plants, and on the bloom on leaves.
May: Contribution to *Nature*.
Second edition of *Different Forms of Flowers*.
Wrote prefatory letter to Kerner's *Flowers and Their Unbidden Guests*.
- 1879 The whole year at work on movements of plants, except for "about six weeks" in the spring and early summer given to the *Life of Erasmus Darwin*, which was published in the autumn.
Contributions to *Nature*.
- 1880 "All spring finishing MS. of *Power of Movement in Plants* and proof sheets."
"Began in autumn on *Worms*."
Prefatory notice written for Meldola's translation of Weismann's book.
Nov. 6th: 1,500 copies of *Power of Movement* sold at Murray's sale.
Contributions to *Nature*.
- 1881 During all the early part of the year at work on the "Worm book." Several contributions to *Nature*.
Oct. 10th: The book on *Earthworms* published: 2,000 copies sold at once.
Nov.: At work on the action of carbonate of ammonia on plants.
- 1882 No entries in the Diary.
Feb.: At work correcting the sixth thousand of the *Earthworms*.

- 1882 Mar. 6th and Mar. 16th: Papers on the action of Carbonate of Ammonia on roots, etc., read at the Linnæan Society.
- April 6th: Note to *Nature* on Dispersal of Bivalves.
- April 18th: Van Dyck's paper on Syrian Dogs, with a preliminary notice by Charles Darwin, read before the Zoological Society.
- April 19th: Charles Darwin died at Down.

APPENDIX II

LIST OF WORKS BY CHARLES DARWIN*

- Narrative of the Surveying Voyages of her Majesty's Ship *Adventure* and *Beagle* between the Years 1826 and 1836, Describing Their Examination of the Southern Shores of South America, and the *Beagle's* Circumnavigation of the Globe. Vol. III. Journal and Remarks, 1832-1836. By Charles Darwin. 8vo. London, 1839.
- Journal of Researches into the Natural History and Geology of the Countries Visited during the Voyage of H.M.S. *Beagle* round the World, under the Command of Capt. Fitz-Roy, R.N. 2d edition, corrected, with additions. 8vo. London, 1845. (Colonial and Home Library.)
- A Naturalist's Voyage. Journal of Researches, etc. 8vo. London, 1860. (Contains a postscript dated Feb. 1, 1860.)
- Zoology of the Voyage of H.M.S. *Beagle*. Edited and superintended by Charles Darwin. Part I. Fossil Mammalia, London, 1840.
- Part II. Mammalia. London, 1839.
- Part III. Birds, by John Gould. London, 1841.
- Part IV. Fish. London, 1842.
- Part V. Reptiles. London, 1843.
- The Structure and Distribution of Coral Reefs. Being the First Part of the Geology of the Voyage of the *Beagle*. 8vo. London, 1842.
- The Structure and Distribution of Coral Reefs. 2d edition. 8vo. London, 1874.
- Geological Observations on the Volcanic Islands, Visited during the Voyage of H.M.S. *Beagle*. Being the Second Part of the Geology of the Voyage of the *Beagle*. 8vo. London, 1844.
- Geological Observations on South America. Being the Third Part of the Geology of the Voyage of the *Beagle*. 8vo. London, 1846.

*From *Life and Letters of Charles Darwin*, edited by Francis Darwin.

- Geological Observations on the Volcanic Islands and Parts of South America Visited during the Voyage of H.M.S. *Beagle*. 2nd edition. 8vo. London, 1876.
- A Monograph of the Fossil Lepadidæ; or Pedunculated Cirripedes of Great Britain. 4to. London, 1851. (Palæontographical Society.)
- A Monograph of the Sub-class Cirripedia, with Figures of All the Species. The Lepadidæ; or, Pedunculated Cirripedes. 8vo. London, 1851. (Ray Society.)
- The Balanidæ (or Sessile Cirripedes); the Verrucidæ, etc. 8vo. London, 1854. (Ray Society.)
- A Monograph of the Fossil Balanidæ and Verrucidæ of Great Britain. 4to. London, 1854. (Palæontographical Society.)
- On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life. 8vo. London, 1859. (Dated Oct. 1, 1859, published Nov. 24, 1859.)
- Fifth thousand. 8vo. London, 1860.
- Third edition, with additions and corrections. (Seventh thousand.) 8vo. London, 1861. (Dated March, 1861.)
- Fourth edition, with additions and corrections. (Eighth thousand.) 8vo. London, 1866. (Dated June, 1866.)
- Fifth edition, with additions and corrections. (Tenth thousand.) 8vo. London, 1869. (Dated May, 1869.)
- Sixth edition, with additions and corrections to 1872. (Twenty-fourth thousand.) 8vo. London, 1872. (Dated Jan., 1872.)
- On the Various Contrivances by which Orchids Are Fertilised by Insects. 8vo. London, 1862.
- Second edition. 8vo. London, 1877.
- The Movements and Habits of Climbing Plants. Second edition. 8vo. London, 1875. (First appeared in the ninth volume of the "Journal of the Linnæan Society.")
- The Variation of Animals and Plants under Domestication. 2 vols. 8vo. London, 1868.
- Second edition, revised. 2 vols. 8vo. London, 1875.
- The Descent of Man, and Selection in Relation to Sex. 2 vols. 8vo. London, 1871.
- Second edition. 8vo. London, 1874. (In 1 vol.)

- The Expression of the Emotions in Man and Animals. 8vo. London, 1872.
- Insectivorous Plants. 8vo. London, 1875.
- The Effects of Cross and Self Fertilisation in the Vegetable Kingdom. 8vo. London, 1876.
- Second edition. 8vo. London, 1878.
- The Different Forms of Flowers on Plants of the Same Species. 8vo. London, 1877.
- Second edition. 8vo. London, 1880.
- The Power of Movement in Plants. By Charles Darwin, assisted by Francis Darwin. 8vo. London, 1880.
- The Formation of Vegetable Mould, through the Action of Worms, with Observations on Their Habits. 8vo. London, 1881.

LIST OF SCIENTIFIC PAPERS, ETC.

- Letters to Professor Henslow, read at the meeting of the Cambridge Philosophical Society, Nov. 16, 1835.
- Geological Notes Made during a Survey of the East and West Coasts of South America in the Years 1832, 1833, 1834, and 1835; with an Account of a Transverse Section of the Cordilleras of the Andes between Valparaiso and Mendoza.
- Notes upon the Rhea Americana. 1837.
- Observations of Proofs of Recent Elevation on the Coast of Chile, Made during the Survey of H.M.S. *Beagle*. 1838.
- A Sketch of the Deposits Containing Extinct Mammalia in the Neighbourhood of the Plata. 1838.
- On Certain Areas of Elevation and Subsidence in the Pacific and Indian Oceans, as Deduced from the Study of Coral Formations. 1838.
- On the Formation of Mould. 1838.
- On the Connexion of Certain Volcanic Phenomena and on the Formation of Mountain-Chains and the Effects of Continental Elevations. 1838.
- Origin of Saliferous Deposits. Salt Lakes of Patagonia and La Plata. 1838.
- Note on a Rock Seen on an Iceberg in 16° South Latitude. 1839.
- Observations on the Parallel Roads of Glen Roy, and of Other Parts of Lochaber in Scotland. 1839.

- On a Remarkable Bar of Sandstone off Pernambuco, on the Coast of Brazil. 1841.
- On the Distribution of the Erratic Boulders and on the Contemporaneous Unstratified Deposits of South America. 1842.
- Notes on the Effects Produced by the Ancient Glaciers of Caernarvonshire, and on the Boulders Transported by Floating Ice. 1842.
- Observations on the Structure and Propagation of the genus *Sagitta*. 1844.
- Brief Descriptions of Several Terrestrial *Planariæ*. 1844.
- An Account of the Fine Dust which Often Falls on Vessels in the Atlantic Ocean. 1846.
- On the Geology of the Falkland Islands. 1846.
- On the Transportal of Erratic Boulders from a Lower to a Higher Level. 1848.
- On British Fossil Lepadidæ. 1850.
- Analogy of the Structure of Some Volcanic Rocks with that of Glaciers. 1851.
- On the Power of Icebergs to Make Rectilinear, Uniformly Directed Grooves across a Submarine Undulatory Surface. 1855.
- Vitality of Seeds. 1855.
- On the Action of Sea-Water on the Germination of Seeds. 1856.
- On the Agency of Bees in the Fertilisation of Papilionaceous Flowers. 1857.
- On the Tendency of Species to Form Varieties; and on the Perpetuation of Varieties and Species by Natural Means of Selection. By Darwin and Wallace. 1859. (Read July 1, 1858.)
- On the Agency of Bees in the Fertilisation of Papilionaceous Flowers, and on the Crossing of Kidney Beans. 1858.
- Do the Tineina or Other Small Moths Suck Flowers, and If So What Flowers? 1860.
- Note on the Achenia of *Pumilio Argyrolepis*. 1861.
- Fertilisation of Vincas. 1861.
- On the Two Forms, or Dimorphic Condition, in the Species of *Primula*, and On Their Remarkable Sexual Relations. 1862.
- On the Three Remarkable Sexual Forms of *Calasetum tridentatum*. 1862.
- Yellow Rain. 1863.

- On the Thickness of the Pampean Formation near Buenos Ayres. 1863.
- On the So-called "Auditory-sac" of Cirripedes. 1863.
- On the Existence of Two Forms, and On Their Reciprocal Sexual Relation, in Several Species of the genus *Linum*. 1864.
- On the Sexual Relations of the Three Forms of *Lythrum salicaria*. 1865.
- On the Movement and Habits of Climbing Plants. 1867.
- Notes on the Fertilization of Orchids. 1869.
- On the Character and Hybrid-like Nature of the Offspring from the Illegitimate Unions of Dimorphic and Trimorphic Plants. 1869.
- Note on the Habits of the Pampas Woodpecker. 1870.
- Fertilisation of *Leschenaultia*. 1871.
- The Fertilisation of Winter-flowering Plants. 1869.
- Pangenesis. 1871.
- Inherited Instinct. 1873.
- Perception in the Lower Animals. 1873.
- Origin of Certain Instincts. 1873.
- Habits of Ants. 1873.
- On the Males and Complemental Males of Certain Cirripedes, and on Rudimentary Structures. 1873.
- Recent Researches on Termites and Honey-bees. 1874.
- Fertilisation of the *Fumariaceæ*. 1874.
- Flowers of the Primrose Destroyed by Birds. 1874.
- Cherry Blossoms. 1876.
- Sexual Selection in Relation to Monkeys. 1876.
- The Scarcity of Holly Berries and Bees. 1877.
- Note on Fertilization of Plants. 1877.
- A Biographical Sketch of an Infant. 1877.
- Transplantation of Shells. 1878.
- Rats and Water-Casks. 1879.
- Fertility of Hybrids from the Common and Chinese Goose. 1880.
- The Sexual Colours of Certain Butterflies. 1880.
- Sir Wyville Thomson and Natural Selection. 1880.
- The Omori Shell Mounds. 1880.
- Black Sheep. 1880.
- Movements of Plants. 1881.
- The Movements of Leaves. 1881.
- Inheritance. 1881.

Leaves Injured at Night by Free Radiation. 1881.

The Parasitic Habits of *Molothrus*. 1881.

On the Dispersal of Freshwater Bivalves. 1882.

The Action of Carbonate of Ammonia on the Roots of Certain Plants. 1882.

The Action of Carbonate of Ammonia on Chlorophyll-Bodies. 1882.

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