

Life Among the Butterflies

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CONTENTS

Chapter I. Books About Butterflies

Linnaeus—Clerck—Fabricius—
Peter Cramer—Hübner—Smith
and Abbot—Boisduval and
LeConte—Harris—Morris—W.
H. Edwards—S. H. Scudder—G.
H. French—C. J. Maynard—W.
J. Holland—William G.
Wright—Longstaff—C. M.
Weed.

Chapter II. The Butterfly's Body

The Head, Eyes, and Mouth
Parts—The Thorax, Wings, and
Legs—The Abdomen—The
Digestive Apparatus—The
Circulatory System—The
Respiratory Tract—The
Excretory Organs—The Nervous
System—The Reproductive
Organs.

Chapter III. Butterfly Metamorphosis

The First Stage or Egg—The

Second or Larval Stage—The
Third or Pupal Stage—The
Fourth Stage or Imago.

Chapter IV. The Case of the Red Silverwing

Oviposition—The Egg—The
Emergence of the Caterpillar—
The Caterpillar—Moulting—
Pupation—The Chrysalis—Pupal
Movements—The Appearance of
the Butterfly.

Chapter V. The Classification of Butterflies

Subkingdoms, Classes, Orders
and Suborders—The Four
Families—Subfamilies, Genera,
and Species—The Value of
Scientific Nomenclature—
Varieties.

Chapter VI. The Four Families

The Four-footed Butterflies—
The Euploeinae—The
Heliconiinae—The
Nymphalinae—The Satyrinae—
The Libytheinae—The
Gossamer-winged Butterflies—
The Lycaeninae—The

Swallowtails and their Allies—
The Pierinae—The
Papilioninae—The Skippers.

Chapter VII. Enemies and
Protection

Protective Coloration—
Offensive Odors and Tastes—
Warning Coloration—Protective
Mimicry—Heliotropism and
List—Feigning Death.

LIFE AMONG THE BUTTERFLIES

CHAPTER I

BOOKS ABOUT BUTTERFLIES

Many ancient and mediaeval writers dealt with butterflies, but the first descriptions of American species are found in the works of Linnaeus, the great Swedish naturalist who wrote about 1750, and invented the system upon which all modern classification is based. Pictures of several American butterflies were published in 1759 by Charles Clerck, who had studied with Linnaeus.

Johann Christian Fabricius, a professor at the University of Kiel, published a few more descriptions in 1796, and Peter Cramer, at about the same time, brought out four large volumes on the butterflies of Asia, Africa, and the Americas. Most of these early books were written in Latin, and are now so rare and expensive that few American students have ever seen them.

Jacob Hübner published his great volumes on exotic butterflies in the early part of the nineteenth century. This work was written in German, and contained more than six hundred colored plates, but a good copy now costs about eight hundred dollars, and is of very little use anyway.

In 1797 Sir James Edward Smith brought out his two-volume work on *The Natural History of the Rarer Lepidopterous Insects of Georgia*, the first books ever devoted exclusively to North American species. This work is valuable chiefly because it contains some drawings by John Abbot, an Englishman who had actually lived in Georgia and studied moths and butterflies at first hand. Some of Abbot's pictures were later used in another work on

American lepidoptera by Dr. J. A. Boisduval of Paris, and Major J. L. LeConte of New York, who wrote in French about 1833. The books of both Smith and Boisduval are now practically unobtainable.

In 1841 the Biological Survey Commission of Massachusetts published a report on injurious insects by Dr. Thaddeus William Harris, which described many New England butterflies. It is now out of print, the last edition appearing in 1862.

The Rev. John G. Harris brought together a deal of information from the works of other writers, and made a few minor observations of his own; his compilation was published by the Smithsonian Institution about 1860.

In 1868 William H. Edwards, an engineer who lived in Coalburg, West Virginia, brought out the first volume of his famous work, *The Butterflies of North America*—probably the best book on the subject ever written. Edwards laboriously worked out the life-histories of many species, and illustrated the work by careful drawings and paintings of his own. Two more volumes appeared later, the last one published in 1897. *The Butterflies of North America* is a magnificent piece of work, produced under all sorts of handicaps, and will always be a classic to American students of the subject.

In 1886 Dr. Samuel Hubbard Scudder published his *Butterflies of New England* in three volumes; this monograph is superbly illustrated, and compares very favorably even with the epoch-making work of Edwards. The works of Edwards and Scudder are probably the best books on butterflies ever written in any language, and must always remain as monuments of American industry and

scholarship. Because of the excessive cost of reproducing the colored plates, however, they are both rather expensive; Scudder's work retailed at ninety dollars, while Edward's three volumes never sold for less than a hundred and fifty, and even this price, according to Dr. W. J. Holland, was below the cost of manufacture.

The Butterflies of the Eastern United States, by G. H. French, appeared about 1886. It is a good little book, and is still in common use, but the illustrations are few and unsatisfactory.

In 1891 C. J. Maynard published a *Manual of North American Butterflies* with ten colored plates; the plates are very poor indeed, and the text not much better.

In 1893 Dr. Samuel Hubbard Scudder, the author of the three great volumes on the New England species, brought out a little book called *The Life of a Butterfly*. It is a brief and popular account of the life-history of *Anosia plexippus*, the Monarch or Milkweed butterfly, which is common everywhere. Dr. Scudder's *Brief Guide to the Commoner Butterflies of the Northern United States and Canada* also appeared in 1893—a very useful little book.

In 1898 Dr. W. J. Holland, Director of the Carnegie Museum at Pittsburgh, published his famous *Butterfly Book*, in which he described more than five hundred species, accompanying each description with a sketch of the life-history and habits in all cases where these details were known. The magnificent colored photograph plates are quite equal for all practical purposes to the hand-colored drawings of Edwards and Scudder, and enable the veriest tyro to classify any of the commoner butterflies simply by comparing them with the pictures. Besides the detailed description of each species there is a great deal of miscellaneous information

of interest to the general reader. Because of the new process of reproducing photographs in colors the book sold very cheaply—never more than four or five dollars—and has done more to arouse a popular interest in butterflies than all other works together. Many of the elementary books since 1898 are indebted to Holland's book, and the present booklet is no exception.

In 1905 William Greenwood Wright of San Francisco, published a book called *West Coast Butterflies*. This work is illustrated with colored plates nearly as good as Holland's, and is indispensable to those interested in California species.

George B. Longstaff's *Butterfly-Hunting in Many Lands* appeared in 1912. The book itself is of no great interest to North Americans, as Longstaff spent only two weeks here, and came no farther south than Montreal. Still, his chapter of *Bionomic Notes* deals with butterflies in general and is well worth reading. The best part of the book, however, is the appendix, which contains E. A. Elliott's translations of Fritz Müller's famous papers on scent-producing organs in butterflies. The most important of these had never been published except in some obscure Portuguese journals, practically inaccessible to the American student.

In 1916, encouraged by the success of his *Butterfly Book*, Dr. Holland prepared a pocket manual called the *Butterfly Guide*, with colored figures representing some two hundred and fifty species.

In 1917 there appeared Clarence M. Weed's *Butterflies Worth Knowing*, with thirty-two plates in color. This is one of the best of the smaller popular books, and contains a great deal of valuable modern material, but is not to be compared with Holland's work.

No important popular books on butterflies have appeared in recent years. The best single work for the general reader is still Holland's *Butterfly Book*; those living west of the Rockies should have Wright's *West Coast Butterflies* also.

CHAPTER II

THE BUTTERFLY'S BODY

The body of a butterfly, like that of any other insect, is divided by constrictions into three parts: the head, the thorax, and the abdomen. The head carries the eyes, antennae, and mouth parts; the thorax bears the legs and wings; and the abdomen the sexual appendages.

THE HEAD, EYES, AND MOUTH PARTS

The *head* is globular, usually a little flattened from front to rear. Two large *compound eyes* are located at the sides of the head, and the face or front consists largely of a plate called the *clypeus*. Above the clypeus and between the eyes are the *antennae* or feelers, which are believed to be the organs of hearing, smell, and touch. Below the clypeus is the *labrum* or upper lip, and the rudimentary *mandibles*; just below these are the two *maxillae*, which unite to form a tube called the *proboscis*, used in sucking nectar out of flowers. When not in use the proboscis is coiled up like a watch-spring between the two three-jointed *labial palpi*. The *labium* or lower lip is very small in butterflies.

THE THORAX, WINGS AND LEGS

The *thorax* is composed of three segments, the front part or prothorax, the middle part or mesothorax, and the hind part or metathorax. The *prothorax* bears the front legs; the *mesothorax* the second pair of legs and the fore wings; the *metathorax* carries the

third pair of legs and the hind wings. The under side of the thorax is called the *pectus* or breast. The large muscles which operate the legs and wings are contained in the thorax. One pair of *spiracles* or breathing-holes is found in the prothorax; the other seven pairs are located in the abdominal segments.

The butterfly has four *wings*, which are the largest and most conspicuous part of the insect. The wings consist of membranes stretched over horny tubes called veins; in the newly emerged insect the veins contain both blood and air, but the veins of the adult contain air only. The colors of the wing are due to minute *scales* which cover the membranes in an overlapping fashion like shingles on a roof. The scales vary considerably in size and form as well as in color, and the males of some species bear specialized scales known as *androconia*, which produce odors attractive to the females. The third of the wing nearest the body is the *base*; the middle part of the wing is the *median* or *discal* area; the outer portion is called the *limbal* area. The front edge is the *costal margin*; the outer edge is the *external margin*; the posterior edge is known as the *inner margin*. The angle of the outer and inner margins of the front wings is called the outer angle, and the corresponding angle of the hind wings is the inner or anal angle. The outmost tip of the front wing is called the *apex*.

The fore wing has three simple veins: the *costal*, the *radial*, and the *submedian*. There are also two branching veins, the *median* and the *subcostal*. The median vein has three branches or nervules, while the subcostal usually has four or five. The hind wing has five simple veins: the *costal*, *subcostal*, *upper radial*, *lower radial*, *submedian*, and *internal*. The costal vein in the hind wing usually has a short ascending spur called the *precostal* vein but it is classed as a simple vein none the less. The median vein has three nervules,

as in the fore wing. In both fore and hind wings, between the subcostal and median veins, there is an area called the *cell*, which is often closed or partially closed on the outer side by three *discocellular veins*, designated as upper, middle, and lower.

Each of the six *legs* is divided into five parts. The section nearest the body is the *coxa*, which is attached to the ring-like *trachanter*. Next beyond the trachanter is the *femur*, then the *tibia*, and finally the *tarsus* or foot bearing the tarsal claws, which are used in clinging to various objects when the butterfly is at rest. In some species the fore legs are small and quite useless, a fact which is used in classification.

THE ABDOMEN

The *abdomen* is composed of ten segments; the first seven bear *spiracles* or breathing-holes (completely hidden by scales, however) and the last two segments are modified to form external sexual appendages. In the male there is a pair of *claspers* for holding the female during copulation; in the female there is only a short and simple *ovipositor*.

THE DIGESTIVE APPARATUS

The *alimentary canal*, the principal part of the digestive apparatus, is a tube extending through the entire body from the end of the proboscis to the anal opening. Just above the proboscis is a *bulb*, which is enlarged by the contraction of muscles attached to the hard parts of the head. When the bulb is expanded nectar may be sucked up through the proboscis; then the valve at the end of the proboscis is closed, and the bulb contracted again. By this means the liquid is forced back into the *esophagus* or gullet, and hence

into the *crop*. Just behind the crop is the *stomach*, and just behind the stomach is the *small intestine*. From the small intestine the part of the liquid not absorbed flows into the *large intestine*, which is divided into a front part or *colon*, and a rear and lower part called the *rectum*. From the rectum the fecal matter passes out of the body through the *anal opening*.

THE CIRCULATORY SYSTEM

The *circulatory system* consists essentially of a single blood vessel, running the entire length of the body in about the position occupied by the spinal column in the higher animals. This tube is open at the rear, and has valves opening inward all along its sides. In the thorax there is a pulsating enlargement which serves as a simple *heart*. The *blood* is a colorless liquid which percolates about through the entire body cavity, not being confined to any particular arteries or veins. It is ultimately collected into the dorsal blood vessel, and the pulsating heart keeps it moving, so that it absorbs food from the stomach and intestines, and distributes it to the various parts of the body.

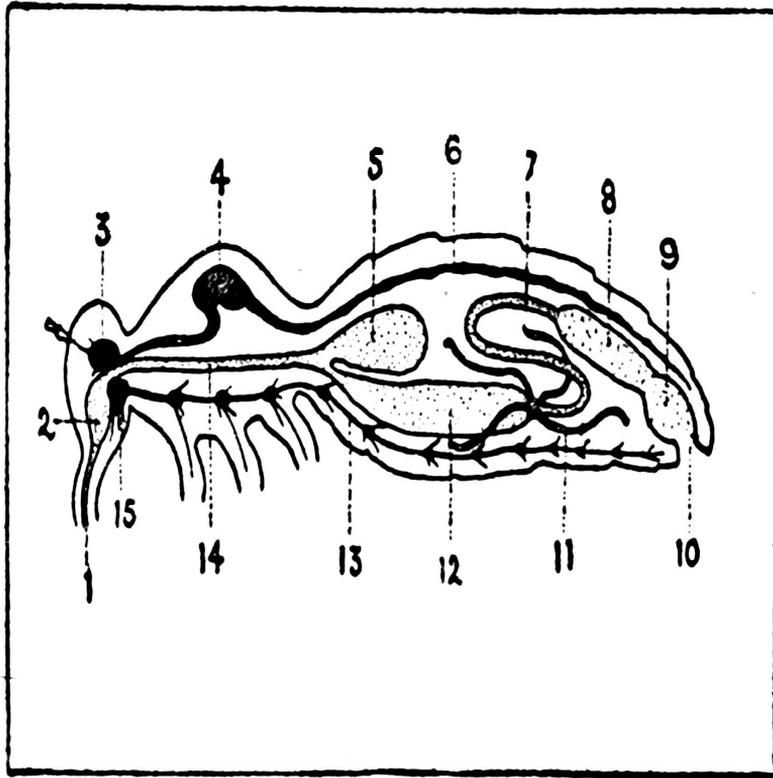


Fig. I.—Diagram showing internal structure. 1, proboscis; 2, bulb; 3, brain; 4, heart; 5, crop; 6, dorsal blood vessel; 7, small intestine; 8, colon; 9, rectum; 10, anal opening; 11, Malpighian tubule; 12, stomach; 13, ventral nerve cord; 14, esophagus; 15, subesophageal ganglion.

THE RESPIRATORY TRACT

Insects have no lungs, and the blood does not carry oxygen about as in the higher animals; air is drawn into the body and brought into direct and immediate contact with the tissues. In the butterfly there are eight pairs of *spiracles* or breathing-holes—seven pairs in the abdomen and one in the prothorax. These spiracles are connected with large *air-sacs* reaching from one end of the body to the other, each air-sac being provided with minute branching tubes called *tracheae*, which carry air directly to the various tissues of the body. The carbon dioxide produced in the respiratory changes passes out through the spiracles, the transfer of gases being produced largely by movements of the abdominal muscles.

THE EXCRETORY ORGANS

The abdomen of the butterfly contains a number of slender *Malpighian tubules*, in contact with the blood contained in the various cavities. These tubules extract waste matter from the blood, functioning just as kidneys do in the higher animals. The butterfly has no bladder or urethra, however; the Malpighian tubules empty into the small intestine, and the urine passes out of the body with the fecal matter.

THE NERVOUS SYSTEM

The nervous system consists of the brain, the subesophageal ganglion, and the ventral nerve cord, together with branches of these structures. The *brain* is a large mass of nerve tissue in the head just above the esophagus. The two *optic nerves* which supply the large compound eyes make up the principal part of the brain, being much larger and more complicated than the *cerebrum*, which is supposed to be the organ of sensation.

The *subesophageal* ganglion is a sort of second brain lying just below the esophagus; it gives off nerves which supply the mouth parts and control the mechanism of feeding. The *ventral nerve cord* runs back from the subesophageal ganglion and traverses almost the entire length of the body, being analogous to the spinal cord of the vertebrates. It bears three *ganglia* in the thoracic region which give off nerves to the legs, wings, and thoracic muscles. Other ganglia, located in the abdomen, have many branching nerves which are distributed to the abdominal muscles and the viscera.

THE REPRODUCTIVE ORGANS

The *ovaries* in the female butterfly are sometimes so large as to crowd the other organs in the abdominal cavity. They communicate by means of tubes called *oviducts* with the *copulatory* apparatus at the end of the abdomen. The *testes* of the male butterfly are usually combined into a single organ; they discharge the *seminal fluid* into the *vas deferens*, whence it is conducted to a sort of pouch near the penultimate segment of the abdomen. In copulation the ends of the male and female abdomens are locked together by certain clasping appendages, and the seminal fluid of the male is forced into the body of the female, where it meets and fertilizes the eggs as they descend from the ovaries.

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