June 1810.

Boston Dec.r 1st. 1810

Insects –

We came now to the most captivating part of Nat.l History, viz Insects. They are so called on account of the sections, or divisions of their bodies. But smallness with a creeping motion does not constitute an Insect. Insects are defined to be "little animals without red blood, "bones or cartilages, furnished with a trunk, or else a "mouth opening perpendicularly; with no eyelids, or "covering to the eyes, and with lungs ~~opening~~ which have "their openings on the sides." Most insects have mouths very different from all other animals. It is a mouth drawn out to a rigid point, or beak, & serving the double purpose of mouth & nose, & is called Proboscis. –

Insects are curious in their structure, & wonderful in their economy; yet are they less perfect than birds. This we infer from their living a long time when deprived of ~~their~~ those organs through which they breathe, and of their hearts, (or what answers to the heart) and after being deprived of their heads. Insects have not skulls filled with brain, like the higher order of animals; but have a spinal-marrow running from their head through their whole length, resembling a white thread full of knots or ganglions. From these knots

knots proceed the nerves that give sense & motion to all parts of the insect. On this medullary thread, and of the same length is placed the Intestinal tube; that is, the œsophagus, stomach & Intestines. Parellel to this alimentary canal runs a long thin vessel, wc is observed to pulsate, or palpitate quite through the skin. It is this vessel wc performs the office of the ~~heart~~ heart.

The Lungs or breathing-vessels open on the sides of the insect, by what are called spiracula, or breathing holes. Around each spiraculum, the tracheal artery pushes forth a great number of branches, wc are again divided into smaller ones; these are subdivided, & spread through the whole body of the insect. Shut an insect up in ever so confined a place & you cannot stifle him; but stop up his breathing holes with oil, or any other glutinous fluid & he soon expires. Many insects have 18 breathing holes, & some have 20 – Instead of a heart like ours, Insects have only an enlarged blood vessel. Let us now notice the external parts of Insects

I. The Head includes the Antennæ, Mouth, Palpi, mandibles & Eyes; sometimes the Tongue; and in some the Jaw & Horns.

The Antennæ are of different shapes, according to the different Genera; and instituted not only for guiding the little animal in its march, but for some other purposes, of which we are ignorant. It may be an organ for some sense of which a man has no conception;—something different from seeing, simple feeling, tasting, or smelling. We only know that the Antennæ are endued with an exquisite sensation. Next to the antennæ come the Palpi, or what the French call the Antennules, or little antennæ. These palpi are little short feelers placed close to the mouth; and are variously shaped, as may be seen by comparing those of the faranaceous with those of the crustaceous, and other tribes, consisting of a greater or less number, according to the species or genus; some having only two palpi, some four, & some eight. The Mouth of Insects is generally placed in the head; but sometimes in the breast, as in the Spiders; sometimes it terminates in a horny beak, (as in Plate 42. fig 3 of Drury's exotic Insects)

Clypeus w.c covers the mouth

The Mandibles are of a horny substance, & move transversely, & situated immediately under ye covering of the mouth called Clypeus.

The Eyes are generally immoveable, and some adapted to see only in the night; others only in the daytime. Their eyes differ in number, according to the genera & species, having in general only two, but in some five, and in others eight, as in spiders.

The Tongue is sometimes curled up in a spiral form, like the spring

spring of a watch, as in Butterflies, and in some Moths: In others it is doubled under the head, as in Bees, & Wasps; but a great many are destitute of tongues.

II^d. The Trunk is composed of the Thorax, Breast; and in some the Escutcheon; in others the Gorget & abdominal Scales.

The Thorax, is the upper part, answering to the shoulders and back of other animals, terminating in some species, in a triangular manner, so as to represent the Escutcheon as in Drury's plate 33, fig. 5. 6. & 8.

The Breast is the under part of the thorax, and always furnished with legs: in some species only four, in others all of them are fixed to it.

The Escutcheon is a small but hard part, ~~of the breast~~ like a scale, placed behind the thorax, & joining to it, and is most commonly of a triangular shape. It is not common to every genus, being chiefly confined to the crustaceous, semi-crustaceous, and transparent-winged class.

The Gorget, or Sternum is united to the fore part of the breast, and extends beyond the middle legs towards the fore ones; and observable only in some species of the crus-taceous-winged class.

The Abdominal Scales are discoverable only in some particular species, [dung beetles*] There are two of them placed on the sides of the breast next to the abdomen, under the hinder ~~legs~~ thighs. In some they are placed remote and distinct

* Les pilulaires. Fr.

distinct from it; in others they lie close; in some they are moveable; in others they are fixed. The use of these parts we are ignorant of.

The Abdomen consists of a number of annuli, or rings, and contains the greatest part of the Intestines & other viscera. In the abdomen are the spiracula, or holes, through which the Insect breathes. The wings are fixed to the abdomen of some insects. It also contains the sting, and in some simply a tail.

III. The Limbs comprehend the Tail, Legs & Wings, with their cases.

The Tail is placed at the extremity of the abdomen; and in some is furnished with a sting; in others it is armed with a p.r of forceps, or pincers: - in some there is only a single bristle; sometimes there is a double one: Some have there a pair of claws, like a crab; while others have a fork.

The Legs include the thighs, shins, & what some call the beaters.* Sometimes the legs consists of two, sometimes of three, four, or five articulations. In some the fore ones resemble crab's claws. Some are furnished with spines, others are smooth & plain. The hinder ones are formed for running, leaping or swimming.

The Wings, w.c are always two or four, are either plain or folded; erect or open; lying flat, or inclining downwards

* Les tarses Fr.

In some the wings are dentated, or scalloped; and some are furnished with two projections like tails. see Plate ~~XIX & XX~~ Drury They are also membranaceous, reticulated, or transparent; and frequently adorned w.th beautiful colours. In some they are curiously folded within two crustaceous cases, that are either smooth or rough, striated, furrowed, or punctated. In some these (wing) cases are soft, & flexile; in others hard like horn. Some are semi-crustaceous, or partly soft, & partly crustaceous, as in the Grass-hopper.

Most Insects undergo three transformations. From the egg springs the maggot, or catterpillar (Larva) w.c is soft, & (barren) non productive: it is employed entirely in feeding; & as it grows, it two or three times, changes its skin.

When the Larva has attained its full growth, it changes into a Chrysalis, or Pupa, (Peupa) w.c hardly encreases in size, & is still barren. In this Chrysalis, or Pupa state, Insects appear under five different forms viz

1.st Peupa completa; when the Larva & Pupa are capable of motion, when they take food, & very much resemble the perfect Insect, as in Spiders, Crabs &c

2. Pupa semi-completa; when the Pupa moves, eats, and has wing-cases; the Larvae of these have six feet, as in Grass-hoppers, & Dragon-flies

3. Pupa incompleta; with motionless feet & wings: the

Larvæ have sometimes six, sometimes more feet; sometimes none at all; & their motions are slow, as Bees & Ants, & some Beetles.

4th. Pupa obtecta; with a coriacious skin, so that the thorax & abdomen with the other members can be distinguished, as in Butterflies.

5th. Pupa coarctata; of an oblong cylindrical shape, with no part of the body visible.

The three last species of Pupa are often inclosed in a particular envelope wc the Larva prepares before it suffers its change. Some by means of a viscous juice connect together a number of extraneous bodies, & thus construct a firm habitation, as the Larvæ of beetles &c –

Others as the Phalænæ, by means of a viscid juice, secreted in certain vessels, & prepared by an organ fitted for the purpose, spin a web, in wc their oblong Pupa reposes.

Others, as the Larvæ of the Tenthredos, encircle themselves wth a spacious net work, (as we often see in appletrees) Some Larvæ are fed by the old Insects in particular cells, wc are shut when the animal enters into the Pupa state, as in Bees & Wasps.

The Chrysalids, or Pupæ of Butterflies are sometimes attached to walls, by the hinder extremity of the body, & sometimes they tie themselves by winding a thread round

Elements of Nat. History, belonging to J. Davis –

round their thorax, the ends of wc are fastened to the support (as in Papilio Machaon & Podalirius)

To undergo this change some Larvæ wrap themselves up in leaves; others seek for holes in walls, or the hollows of trees. — Having remained in the chrysalis, or Pupa state for a longer or shorter time, and having in a most wonderful manner, attained all its parts, & utmost size, and put on a very different appearance, the perfect insect bursts its prison. It is now called the Imago; Insectum declaratum, or insectum perfectum.

For the most part the perfect insect eats nothing, or merely sucks the juices of flowers; but there are some that not only eat, but actually grow larger, such as the Sylphidæ & Curculiones.

Few insects live during winter. Most of them die after laying their eggs, wc they produce in vast abundance. Some of the Moths lay 1600 eggs. The Queen Bee about 4000, some say 12,000. The Flesh fly 20,000.

They deposit their eggs with great care in that particular place wc affords the most proper nourishment for the young when hatched. But as soon as this duty is performed they for ever abandon them, to be hatched by the warmth of the atmosphere. Of the whole tribe of Insects, the working Bees & Ants alone, take care of their young. Spiders carry their eggs about with them in a bag, & for a short time they carry their young on their backs —

The female of Insects is most commonly the largest. Sometimes they want wings, while the male is provided with them.

Linnæus divides this class of animals into seven orders.

Order 1st. Coleoptera. They have four wings, the two superior ones being crustaceous, & furnished with a straight suture. It contains 55 genera, or kinds, whereof the 1st genus is the Scarabeus. e.g. Hercules

Order 2d. Hemiptera. Have four wings, the two superior ones being semi-crustaceous, & incumbent, i.e. the interior edges lie one above another. This order contains 14 genera, whereof Blatta is the 1st e.g. cockroach Cricket.

Order 3d. Lepidoptera. Have four wings covered with fine scales, like powder, & with a spiral tongue. 3 genera. e.g. Sphinx.

Order 4th. Neuroptera. Have four membraneous transparent wings, interwoven with veins or nerves, like a piece of network. Contains 7 genera, the 1st is Libella.

Order 5th. Hymenoptera. Have four membraneous wings, and the tail armed with a sting. Has 15 genera. e.g. the Bee. The females only are armed with a sting. They generally carry valuable cargoes and ∴ go armed.

Order 6th. Diptera. Have two wings, & two clavated balancers behind each wing. Has 12 genera. e.g. the Fly, & musquito

Order 7th. Aptera. Insects of this order have no wings. It has 15 genera. To this order belong Spiders – Scorpions & Crabs.

The generic characters of Insects are generally taken from the Antennæ; the parts of the mouth, the structure of the head, thorax

and abdomen. But we refer you to Linnæus's Systema Natura for these generic distinctions ——

Description of the 1st order Coleoptera.

The Insects of this order make a very natural division. They have hard cases to their wings, with a longitudinal suture. They have generally four palpi; two horny and two coriaceous maxillæ; the mouth is covered over with the clypeus; & closed below by the lips. They have all 6 feet, in their perfect state; for the most part eleven articulations in the antennæ, wc lie between the two reticulated eyes: They have a hard horny skin; on each side they have 9 spiracula, one on the thorax, & 8 on the abdomen. The females lay their eggs in the earth, & in wood; & from these proceed the Larvæ (or maggots.) The Larvæ have 6 short feet near the head; jaws at the mouth; two eyes; often short antennæ; & on each side 9 spiracula. The larva state, during wc insects change their skin, endures in most of the species, for a year; in the larger species longer, sometimes 3, or 4 years. When the Larva arrives at its appointed, or full time, it draws itself together, & changes for the most part into a Pupa incompleta, wc sometimes reposes in the earth, or in rotten wood for weeks & months. afterwards the skin of the Pupa bursts, & the perfect insect appears.

I have been thus particular, perhaps tedious, to shew you

Introduction to Systema Naturæ.

you with what precision these subjects have been pursued by Naturalists. Were we to branch out into the generic & the specific distinctions, you would probably be surprised at the patience & minute attention of naturalists. You must remember :: that no part of Natural history is so captivating as that w.c relates to insects. Their curious, & almost in-finitely varied structure, as apparent through the microscope is a source of entertainment not to be found in any other department of nature. If we add to this their wonderful instincts, their art in constructing their webs, & their dwell-ings, and the cunning, subtlety & address w.c they ex-ercise in seizing their prey, & in securing their own safety, we shall not be surprised, that men dis-tinguished by talents & learning have become ena-moured with the subject

The transformation, or to speak more correctly, the evolving of the Insect, by w.c he appears in three or four different states & forms is truly surprising, e.g. The egg of a Butterfly being laid in a cabbage, first of all becomes a caterpillar, that feeds upon vegetables, crawls about, and has 16 feet. This afterwards changes into what is called a Nymph, or Chrysalis, w.c has no feet is smooth & eats nothing; and is of no sex; and lastly it bursts open, & out comes a butterfly, that flies about, has a variety of colours, is rough, & feeds upon honey!

It

It is singular that one & the same animal should appear on the stage of life under so many characters, as if it were three distinct animals!

The first change is from ~~the~~ an egg into the Larva, or as it is commonly called, caterpillar state.

The 2d. is from the caterpillar to the chrysalis, or pupa state, & lastly from this state into the perfect, imago, or flying state.

In the Larva, or caterpillar state, it is in the form of a groveling voracious worm, with a long body, composed of successive rings. It crawls along by the help of little hooks, placed on the side of the Insect. Its head is armed with strong jaws, its eyes smooth, and it is destitute of sex. While in the Larva state the insects true form is concealed under a mask — In the pupa state, the insect has been compared to a baby wrapt up in its cloths [more applicable to babies where Linnæus lived] In this state it eats nothing. Finally he casts off the spoils of his former state, & appears in his perfect state, furnished with wings, magnificently adorned, and sporting in the air, the delight & admiration of beholders.

If these contemptible, crawling worms, can be thus changed, can we think it unlikely, or impossible, that these vile bodies of ours may be changed also, so that this corruptible shall put on the incorruptible, & this mortal assume a glorious immortality!

The Caterpillar, whose life is one continued succession of changes, often moults its skin before it attains its full growth. These are the more singular, because when it moults it is not simply the skin that is changed; for we find in the exuvia, the skull, jaws, & all the exterior parts, both scaly & membranaceous, wc. compose its upper & under lip; its antennæ, palpi, and even those crustaceous pieces within the head, wc. serve as a fixed basis to a number of muscles; we also find in the exuvia, the spiracles, the claws, & sheaths of the anterior legs, and in general the traces of all that is visible in the external figure of the caterpillar.

Bergman distinguishes three kinds of pupa, wc. he calls chrysalids, nymphs, and semi-nymphs. The first he describes as hard & motionless, that does not eat, and ~~is hardly different~~ shews obscurely the members of the future insect; the nymph is tender, lying at rest, not eating, & wc. shews clearly the seperate members of the future insect; the semi-nymph is furnished with legs, and runs & eats, and is hardly diffct. from the larva, except in having the rudiments of the wings, wc. the larva wants. e.g. Grasshopper,

See Rees Cyclop. Entomology. by Brown.