THE

NATURAL HISTORY

OF

PLINY.

TRANSLATED,

WITH COPIOUS NOTES AND ILLUSTRATIONS

BY THE LATE

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GREEK AND ROMAN MONEY, WEIGHTS, AND MEASURES MENTIONED BY PLINY.

Acetabulum. R	...$\frac{1}{8}$ of a Sextarius, .1238 pint.
Actus. R	...120 Pedes or Roman feet.
Amphora. R	...48 Sextarii, 5 gall. 7.577 pints.
As. R	...$2\frac{1}{8}$ farthings. Copper.
As. R [weight]	...See "Libra."
Concha, Smaller, G and R	...·0412 pint.
Concha, Larger, G and R	...·1238 pint.
Congius. R	...5.9471 pints.
Cubitus. G	...1 foot 6.2016 inches.
Cubitus. R	...1 foot 5.4744 inches.
Culeus. R	...20 Amphoræ, 118 gall. 7.546 pints.
Cyathus. G and R	...$\frac{1}{12}$ of a Sextarius, .0825 pint.
Denarius. R	...16 Asses, $8\frac{1}{2}$ pence. Silver.
Denarius. R. [weight] ...	...52.5 to 60 grains.
Digitus, or Finger. R. ...	...$\frac{1}{16}$ of a Pes, .7281 inch.
Drachma. G	...·63 grains.
Hemina. R	...See "Semisextarius."
Jugerum. R	...240 Pedes or Roman feet by 120.
Libra, or Pound. R. ...	...$11\frac{5}{4}$ ounces 60.45 grains, avoird.
Mina.* G	...15 ounces 83.75 grains, avoird.
Modius. R. [dry measure]	...$\frac{1}{3}$ of an Amphora, 1 gall. 7.8576 pints.
Obolus. G	...$1\frac{1}{2}$.5 pence. Silver.
Obolus. G. [weight] ...	...10.5 grains.
Palmus, or Handbreadth. R	...2.9214 inches.
Passus, or Pace.† R ...	...5 Roman feet, 4 ft. 10.248 inches.

* In B. xii. c. 32—it is supposed by some that it is the Roman Libra that is meant, under the name of "Mina," as containing eighty-four Denarii. If so, it must be the old Roman Libra, as it is more generally thought that the Libra of Pliny's time contained ninety-six Denarii, of sixty grains, within a fraction.

† One thousand Paces made a Roman "Mille Passuum," or Mile, 1618 yards English.

Pes, or Foot. R ... ...12 Unciæ, 11.6496 inches.
Pollex, or Thumb. R ... ...See "Uncia" [lineal measure].
Quadrans. R ... ...53,125 farthing. Copper.
Quadrans. R [weight] ... ...3 Unciæ, $2\frac{3}{4}$ ounces 97.21 grs.
Quadrantal. R ... ...See "Amphora."
Quartarius. R ... ...$\frac{1}{4}$ f a Sextarius, .2477 pint.
Quinarius. R ... ...$\frac{1}{2}$ of a Denarius.
Scripulum, or Scruple. R ...$\frac{1}{24}$ of an Uncia, 18.06 grains.
Semisextarius. R ... ...$\frac{1}{2}$ of a Sextarius.
Sestertius. R ... ...$\frac{1}{4}$ of a Denarius. Brass or Silver.
Sestertium. R ... ...1000 Sestertii, £7 16s 3d.
Sextarius. R ... ...$\frac{1}{6}$ of a Congius, .9911 pint.
Spithama, or Span. G ... ...9.1008 inches.
Stadium. G and R ... ...$\frac{1}{8}$ of a Roman mile, 606 feet 9 in.
Teruncius. R ... ...See "Quadrans" [weight & money].
Ulna, or Ell. R ... ...6 feet, 81 inch.
Uncia, or Inch. R ... ...$\frac{1}{12}$ of a Pes, .9708 inch.
Uncia, or Ounce. R... ... ...$\frac{1}{12}$ of a Libra. 433.666 grs.
Urna. R. ... ...$\frac{1}{2}$ of an Amphora.
Victoriatus. R ... ...See "Quinarius."

The Schœnus, an Egyptian and Persian lineal measure, varied considerably; being sometimes thirty, and sometimes forty Stadia. See B. v. c. 11, B. vi. c. 30, and B. xii. c. 30.

The Attic Talent, as a weight, was equal to 56lb. $15\frac{1}{4}$oz. 100.32 grains. The Commercial Talent was 85lb. $2\frac{1}{2}$oz. 70.7 grs. The Silver Attic, or Great Talent, was in value £343 15s. or, according to Pollux, £406 5s. The Gold, or Sicilian Talent, was equal in weight to six Attic Drachmæ, or about $\frac{3}{4}$ oz. and 71 grs. The Egyptian Talent, as a measure of weight, was equal to about twice the Attic Talent.

NATURAL HISTORY OF PLINY.

BOOK XI.

THE VARIOUS KINDS OF INSECTS.

CHAP. 1. (1.)—THE EXTREME SMALLNESS OF INSECTS.

WE shall now proceed to a description of the insects, a subject replete with endless difficulties ;[1] for, in fact, there are some authors who have maintained that they do not respire, and that they are destitute of blood. The insects are numerous, and form many species, and their mode of life is like that of the terrestrial animals and the birds. Some of them are furnished with wings, bees for instance; others are divided into those kinds which have wings, and those which are without them, such as ants; while others, again, are destitute of both wings and feet. All these animals have been very properly called "insects,"[2] from the incisures or divisions which separate the body, sometimes at the neck, and sometimes at the corselet, and so divide it into members or segments, only united to each other by a slender tube. In some insects, however, this division is not complete, as it is surrounded by wrinkled folds; and thus the flexible vertebræ of the creature, whether situate at the abdomen, or whether only at the upper part of the body, are protected by layers, overlapping each other; indeed, in no one of her works has Nature more fully displayed her exhaustless ingenuity.

(2.) In large animals, on the other hand, or, at all events,

[1] "Immensæ subtilitatis." As Cuvier remarks, the ancients have committed more errors in reference to the insects, than to any other portion of the animal world. The discovery of the microscope has served more than anything to correct these erroneous notions.

[2] "Insecta," "articulated."

in the very largest among them, she found her task easy and her materials ready and pliable; but in these minute creatures, so nearly akin as they are to non-entity, how surpassing the intelligence, how vast the resources, and how ineffable the perfection which she has displayed. Where is it that she has united so many senses as in the gnat?—not to speak of creatures that might be mentioned of still smaller size—Where, I say, has she found room to place in it the organs of sight? Where has she centred the sense of taste? Where has she inserted the power of smell? And where, too, has she implanted that sharp shrill voice of the creature, so utterly disproportioned to the smallness of its body? With what astonishing subtlety has she united the wings to the trunk, elongated the joints of the legs, framed that long, craving concavity for a belly, and then inflamed the animal with an insatiate thirst for blood, that of man more especially! What ingenuity has she displayed in providing it with a sting,[3] so well adapted for piercing the skin! And then too, just as though she had had the most extensive field for the exercise of her skill, although the weapon is so minute that it can hardly be seen, she has formed it with a twofold mechanism, providing it with a point for the purpose of piercing, and at the same moment making it hollow, to adapt it for suction.

What teeth, too, has she inserted in the teredo,[4] to adapt it for piercing oak even with a sound which fully attests their destructive power! while at the same time she has made wood its principal nutriment. We give all our admiration to the shoulders of the elephant as it supports the turret, to the stalwart neck of the bull, and the might with which it hurls aloft whatever comes in its way, to the onslaught of the tiger, or to the mane of the lion; while, at the same time, Nature is nowhere to be seen to greater perfection than in the very smallest of her works. For this reason then, I must beg of my readers, notwithstanding the contempt they feel for many of these objects, not to feel a similar disdain for the information I am about to give relative thereto, seeing that, in the

[3] The trunk of the gnat, Cuvier says, contains five silken and pointed threads, which together have the effect of a sting.

[4] The Teredo navalis of Linnæus, not an insect, but one of the mollusks. This is the same creature that is mentioned in B. xvi. c. 80; but that spoken of in B. viii. c. 74, must have been a land insect.

study of Nature, there are none of her works that are unworthy of our consideration.

CHAP. 2. (3.)—WHETHER INSECTS RESPIRE, AND WHETHER THEY HAVE BLOOD.

Many authors deny that insects respire,[5] and make the assertion upon the ground, that in their viscera there is no respiratory organ to be found. On this ground, they assert that insects have the same kind of life as plants and trees, there being a very great difference between respiring and merely having life. On similar grounds also, they assert that insects have no blood, a thing which cannot exist, they say, in any animal that is destitute of heart and liver; just as, according to them, those creatures cannot breathe which have no lungs. Upon these points, however, a vast number of questions will naturally arise; for the same writers do not hesitate to deny that these creatures are destitute also of voice,[6] and this, notwithstanding the humming of bees, the chirping of grasshoppers, and the sounds emitted by numerous other insects which will be considered in their respective places. For my part, whenever I have considered the subject, I have ever felt persuaded that there is nothing impossible to Nature, nor do I see why creatures should be less able to live and yet not inhale, than to respire without being possessed of viscera, a doctrine which I have already maintained, when speaking[7] of the marine animals; and that, notwithstanding the density and the vast depth of the water which would appear to impede all breathing. But what person could very easily believe that there can be any creatures that fly to and fro, and live in the very midst of the element of respiration, while, at the same time, they themselves are devoid of that respiration; that they can be possessed of the requisite instincts for nourishment, generation, working, and making provision even for time to come, in the enjoyment too (although, certainly, they are not possessed of the organs which act, as it were, as the receptacles

[5] They respire by orifices in the sides of the body, known to naturalists as *stigmata*. The whole body, Cuvier says, forms, in a measure, a system of lungs.

[6] Cuvier remarks that the various noises made by insects are in reality not the voice, as they are not produced by air passing through a larynx.

[7] B. ix. c. 6.

of those senses) of the powers of hearing, smelling, and tasting, as well as those other precious gifts of Nature, address, courage, and skilfulness? That these creatures have no blood[8] I am ready to admit, just as all the terrestrial animals are not possessed of it; but then, they have something similar, by way of equivalent. Just as in the sea, the sæpia[9] has a black liquid in place of blood, and the various kinds of purples, those juices which we use for the purposes of dyeing; so, too, is every insect possessed of its own vital humour, which, whatever it is, is blood to it. While I leave it to others to form what opinion they please on this subject, it is my purpose to set forth the operations of Nature in the clearest possible light, and not to enter upon the discussion of points that are replete with doubt.

CHAP. 3. (4.)—THE BODIES OF INSECTS.

Insects, so far as I find myself able to ascertain, seem to have neither sinews,[10] bones, spines, cartilages, fat, nor flesh; nor yet so much as a frail shell, like some of the marine animals, nor even anything that can with any propriety be termed skin; but they have a body which is of a kind of intermediate nature between all these, of an arid substance, softer than muscle, and in other respects of a nature that may, in strictness, be rather pronounced yielding,[11] than hard. Such, then, is all that they are, and nothing more:[12] in the inside of their bodies there is nothing, except in some few, which have an intestine arranged in folds. Hence it is, that even when cut asunder, they are remarkable for their tenacity of life, and the palpitations which are to be seen in each of their parts. For every portion of them is possessed of its own vital principle, which is centred in no limb in particular, but

[8] Cuvier remarks, that they have a nourishing fluid, which is of a white colour, and acts in place of blood.

[9] The dye of sæpia, Cuvier remarks, is not blood, nor does it act as such, being an excrementitious liquid. It has in addition a bluish, transparent, blood. The same also with the juices of the purple.

[10] "Nervos." Cuvier says that all insects have a brain, a sort of spinal marrow, and nerves.

[11] "Tutius."

[12] Insects have no fat, Cuvier says, except when in the chrysalis state; but they have a fibrous flesh of a whitish colour. They have also viscera, trachea, nerves, and a most complicated organization.

in every part of the body; least of all, however, in the head, which alone is subject to no movements unless torn off together with the corselet. No kind of animal has more feet than the insects have, and those among them which have the most, live the longest when cut asunder, as we see in the case of the scolopendra. They have eyes, and the senses as well of touch and taste; some of them have also the sense of smelling, and some few that of hearing.

CHAP. 4. (5.)—BEES.

But among them all, the first rank, and our especial admiration, ought, in justice, to be accorded to bees, which alone, of all the insects, have been created for the benefit of man. They extract honey and collect it, a juicy substance remarkable for its extreme sweetness, lightness, and wholesomeness. They form their combs and collect wax, an article that is useful for a thousand purposes of life; they are patient of fatigue, toil at their labours, form themselves into political communities, hold councils together in private, elect chiefs in common, and, a thing that is the most remarkable of all, have their own code of morals. In addition to this, being as they are, neither tame nor wild, so all-powerful is Nature, that, from a creature so minute as to be nothing more hardly than the shadow of an animal, she has created a marvel beyond all comparison. What muscular power, what exertion of strength are we to put in comparison with such vast energy and such industry as theirs? What display of human genius, in a word, shall we compare with the reasoning powers manifested by them? In this they have, at all events, the advantage of us—they know of nothing but what is for the common benefit of all. Away, then, with all questions whether they respire or no, and let us be ready to agree on the question of their blood; and yet, how little of it can possibly exist in bodies so minute as theirs.—And now let us form some idea of the instinct they display.

CHAP. 5. (6.)—THE ORDER DISPLAYED IN THE WORKS OF BEES.

Bees keep within the hive during the winter—for whence are they to derive the strength requisite to withstand frosts and snows, and the northern blasts? The same, in fact, is done by all insects, but not to so late a period; as those

which conceal themselves in the walls of our houses, are much sooner sensible of the returning warmth. With reference to bees, either seasons and climates have considerably changed, or else former writers have been greatly mistaken. They retire for the winter at the setting of the Vergiliæ, and remain shut up till after the rising of that constellation, and not till only the beginning of spring, as some authors have stated; nor, indeed, does any one in Italy ever think of then opening the hives. They do not come forth to ply their labours until the bean blossoms; and then not a day do they lose in inactivity, while the weather is favourable for their pursuits.

First of all, they set about constructing their combs, and forming the wax, or, in other words, making their dwellings and cells; after this they produce their young, and then make honey and wax from flowers, and extract bee-glue[12] from the tears of those trees which distil glutinous substances, the juices, gums, and resins, namely, of the willow, the elm, and the reed. With these substances, as well as others of a more bitter nature, they first line the whole inside of the hive, as a sort of protection against the greedy propensities of other small insects, as they are well aware that they are about to form that which will prove an object of attraction to them. Having done this, they employ similar substances in narrowing the entrance to the hive, if otherwise too wide.

CHAP. 6. (5.)—THE MEANING OF THE TERMS COMMOSIS, PISSOCEROS, AND PROPOLIS.

The persons who understand this subject, call the substance which forms the first foundation of their combs, *commosis*,[13] the next, *pissoceros*,[14] and the third *propolis*;[15] which last is placed between the other layers and the wax, and is remarkable for its utility in medicine.[16] The commosis forms the first crust or layer, and has a bitter taste; and upon it is laid the pissoceros, a kind of thin wax, which acts as a sort of varnish. The propolis is produced from the sweet gum of the vine or

[12] "Melligo." For further information on this subject consult Bevan on the Honey Bee.

[13] Or "conusis," "gummy matter."

[14] Pitch-wax.

[15] A kind of bee-glue; the origin of the name does not seem to be known. Reaumur says that they are all different varieties of bee-glue.

[16] See B. xxii. c. 50.

the poplar, and is of a denser consistency, the juices of flowers being added to it. Still, however, it cannot be properly termed wax, but rather the foundation of the honey-combs; by means of it all inlets are stopped up, which might, otherwise, serve for the admission of cold or other injurious influences; it has also a strong odour, so much so, indeed, that many people use it instead of galbanum.

CHAP. 7.—THE MEANING OF ERITHACE, SANDARACA, OR CERINTHOS.

In addition to this, the bees form collections of *erithace* or bee-bread, which some persons call "sandaraca,"[17] and others "cerinthos." This is to serve as the food of the bees while they are at work, and is often found stowed away in the cavities of the cells, being of a bitter flavour also. It is produced from the spring dews and the gummy juices of trees, being less abundant while the south-west wind is blowing, and blackened by the prevalence of a south wind. On the other hand, again, it is of a reddish colour and becomes improved by the north-east wind; it is found in the greatest abundance upon the nut trees in Greece. Menecrates says, that it is a flower, which gives indications of the nature of the coming harvest; but no one says so, with the exception of him.

CHAP. 8. (8.) — WHAT FLOWERS ARE USED BY THE BEES IN THEIR WORK.

Bees form wax[18] from the blossoms of all trees and plants, with the sole exception of the rumex[19] and the echinopodes,[20] both being kinds of herbs. It is by mistake, however, that spartum is excepted;[21] for many varieties of honey that come from Spain, and have been made in the plantations of it, have a strong taste of that plant. I am of opinion, also, that it is without any sufficient reason that the olive has been excepted, seeing that it is a well-known fact, that where olives are in the greatest abundance, the swarms of bees are the most numerous. Bees are not injurious to fruit of any kind; they will

17 Different combinations of the pollen of flowers, on which bees feed.

18 It is formed from the honey that the bee has digested.

19 Sorrel, or monk's rhubarb.

20 A kind of broom.

21 Spanish broom, the Stipa tenacissima of Linnæus. Ropes were made of it. See B. xix. c. 7.

never settle on a dead flower, much less a dead carcase. They pursue their labours within three-score paces of their hives; and when the flowers in their vicinity are exhausted, they send out scouts from time to time, to discover places for forage at a greater distance. When overtaken by night in their expeditions, they watch till the morning, lying on their backs, in order to protect their wings from the action of the dew.

CHAP. 9. (9.)—PERSONS WHO HAVE MADE BEES THEIR STUDY.

It is not surprising that there have been persons who have made bees their exclusive study; Aristomachus of Soli, for instance, who for a period of fifty-eight years did nothing else; Philiscus of Thasos, also, surnamed Agrius,[22] who passed his life in desert spots, tending swarms of bees. Both of these have written works on this subject.

CHAP. 10. (10.)—THE MODE IN WHICH BEES WORK.

The manner in which bees carry on their work is as follows. In the day time a guard is stationed at the entrance of the hive, like the sentries in a camp. At night they take their rest until the morning, when one of them awakes the rest with a humming noise, repeated twice or thrice, just as though it were sounding a trumpet. They then take their flight in a body, if the day is likely to turn out fine; for they have the gift of foreknowing wind and rain, and in such case will keep close within their dwellings. On the other hand, when the weather is fine—and this, too, they have the power of foreknowing—the swarm issues forth, and at once applies itself to its work, some loading their legs from the flowers, while others fill their mouths with water, and charge the downy surface of their bodies with drops of liquid. Those among them that are young[23] go forth to their labours, and collect the materials already mentioned, while those that are more aged stay within the hives and work. The bees whose business it is to carry the flowers, with their fore feet load their thighs, which Nature has made rough for the purpose, and with their trunks load

[22] Or, the "wild man."

[23] Huber has discovered that there are two kinds of bees of neutral sex, or, as he calls them, unprolific females, the workers, which go out, and the nurses, which are smaller, and stay in the hive to tend the larvæ.

their fore feet: bending beneath their load, they then return to the hive, where there are three or four bees ready to receive them and aid in discharging their burdens. For, within the hive as well, they have their allotted duties to perform: some are engaged in building, others in smoothing, the combs, while others again are occupied in passing on the materials, and others in preparing food[24] from the provision which has been brought; that there may be no unequal division, either in their labour, their food, or the distribution of their time, they do not even feed separately.

Commencing at the vaulted roof of the hive, they begin the construction of their cells, and, just as we do in the manufacture of a web, they construct their cells from top to bottom, taking care to leave two passages around each compartment, for the entrance of some and the exit of others. The combs, which are fastened to the hive in the upper part, and in a slight degree also at the sides, adhere to each other, and are thus suspended altogether. They do not touch the floor of the hive, and are either angular or round, according to its shape; sometimes, in fact, they are both angular and round at once, when two swarms are living in unison, but have dissimilar modes of operation. They prop up the combs that are likely to fall, by means of arched pillars, at intervals springing from the floor, so as to leave them a passage for the purpose of effecting repairs. The first three ranks of their cells are generally left empty when constructed, that there may be nothing exposed to view which may invite theft; and it is the last ones, more especially, that are filled with honey: hence it is that the combs are always taken out at the back of the hive.

The bees that are employed in carrying look out for a favourable breeze, and if a gale should happen to spring up, they poise themselves in the air with little stones, by way of ballast; some writers, indeed, say that they place them upon their shoulders. When the wind is contrary, they fly close to the ground, taking care, however, to keep clear of the brambles. It is wonderful what strict watch is kept upon their work: all instances of idleness are carefully remarked, the offenders are

[24] From the honey found in the corollæ of flowers. This, after being prepared in the first stomach of the bee, is deposited in the cell which is formed for its reception.

chastised, and on a repetition of the fault, punished with death. Their sense of cleanliness, too, is quite extraordinary; everything is removed that might be in the way, and no filth is allowed to remain in the midst of their work. The ordure even of those that are at work within, that they may not have to retire to any distance, is all collected in one spot, and on stormy days, when they are obliged to cease their ordinary labours, they employ themselves in carrying it out. When it grows towards evening, the buzzing in the hive becomes gradually less and less, until at last one of their number is to be seen flying about the hive with the same loud humming noise with which they were aroused in the morning, thereby giving the signal, as it were, to retire to rest: in this, too, they imitate the usage of the camp. The moment the signal is heard, all is silent.

(11.) They first construct the dwellings of the commonalty, and then those of the king-bee. If they have reason to expect an abundant[25] season, they add abodes also for the drones: these are cells of a smaller size, though the drones themselves are larger than the bees.

CHAP. 11.—DRONES.

The drones have no sting,[26] and would seem to be a kind of imperfect bee, formed the very last of all; the expiring effort, as it were, of worn-out and exhausted old age, a late and tardy offspring, and doomed, in a measure, to be the slaves of the genuine bees. Hence it is that the bees exercise over them a rigorous authority, compel them to take the foremost rank in their labours, and if they show any sluggishness, punish them[27] without mercy. And not only in their labours do the drones give them their assistance, but in the propagation of their species as well, the very multitude of them contributing greatly to the warmth of the hive. At all events, it is a well-known fact, that the greater[28] the multitude of the drones, the more

[25] Cuvier says that the three kinds of cells are absolutely necessary, and that they do not depend on the greater or less abundance. The *king* of the ancients is what we know as the *queen* bee, which is impregnated by the drones or males.

[26] This is the fact, but not so their *imperfect* state.

[27] They do not work, but merely impregnate the queen; after which they are driven from the hive, and perish of cold and starvation.

[28] It appears, as Cuvier says, that the ancients had *some* notion that the swarm was multiplied by the aid of the drones.

numerous is sure to be the progeny of the swarm. When the honey is beginning to come to maturity, the bees drive away the drones, and setting upon each in great numbers, put them all to death. It is only in the spring that the drones are ever to be seen. If you deprive a drone of its wings, and then replace it in the hive, it will pull off the wings of the other drones.

CHAP. 12.—THE QUALITIES OF HONEY.

In the lower part of the hive they construct for their future sovereign a palatial abode,[29] spacious and grand, separated from the rest, and surmounted by a sort of dome: if this prominence should happen to be flattened, all hopes of progeny are lost. All the cells are hexagonal, each foot[30] having formed its own side. No part of this work, however, is done at any stated time, as the bees seize every opportunity for the performance of their task when the days are fine; in one or two days, at most, they fill their cells with honey.

(12.) This substance is engendered from the air,[31] mostly at the rising of the constellations, and more especially when Sirius is shining; never, however, before the rising of the Vergiliæ, and then just before day-break. Hence it is, that at early dawn the leaves of the trees are found covered with a kind of honey-like dew, and those who go into the open air at an early hour in the morning, find their clothes covered, and their hair matted, with a sort of unctuous liquid. Whether it is that this liquid is the sweat of the heavens, or whether a saliva emanating from the stars, or a juice exuding from the air while purifying itself, would that it had been, when it comes to us, pure, limpid, and genuine, as it was, when first it took its downward descent. But as it is, falling from so vast a height, attracting corruption in its passage, and tainted by the exhalations of the earth as it meets them, sucked, too, as it is from off the trees and the herbage of the fields, and accumulated in the stomachs of the bees—for they cast it up

[29] Cuvier says that the cell for the future queen is different from the others, and much larger. The bees also supply the queen larva much more abundantly with food, and of more delicate quality.

[30] Cuvier says that this coincidence with the number of the legs is quite accidental, as it is with the mouth that the animal constructs the cell.

[31] The basis of it is really derived from the calix or corolla of flowers.

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