Appendix 3.1: from *Zoonomia*, Volume 1 (1794; revised 1801)

Zoonomia was published in two volumes: Vol. 1 in 1794 and Vol. 2 in 1796. The first volume is theoretical and based on the principle of "comparing the properties belonging to animated nature with each other" (Vol. 1, p. 2). The second volume is a taxonomy of diseases, and an explanation of the operations of medicines. In the 1801 edition, ED revised some of his ideas on generation, particularly as to formation from a single filament or many parts, and the relative roles of male and female.

All selections are copied from *Zoonomia; or, The Laws of Organic Life*. Vol. 1. London: J. Johnson, 1794, except for those from the Appendix added to Section XXXIX, "Of Generation," in 1801 (as indicated below), copied from *Zoonomia; or, the Laws of Organic Life*. Vol. 1. London: J. Johnson, 1801.

from Preface

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The great CREATOR of all things has infinitely diversified the works of his hands, but has at the same time stamped a certain similitude on the features of nature, that demonstrates to us, that *the whole is one family of one parent*. On this similitude is founded all rational analogy; which, so long as it is concerned in comparing the essential properties of bodies, leads us to many and important discoveries; but when with licentious activity it links together objects, otherwise discordant, by some fanciful similitude; it may indeed collect ornaments for wit and poetry, but philosophy and truth recoil from its combinations.

Section XIII, Of Vegetable Animation

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S E C T. XIII.

OF VEGETABLE ANIMATION.

I. 1. *Vegetables are irritable, mimosa, dionœa muscipula. Vegetable secretions.* 2. *Vegetable buds are inferior animals, are liable to greater or less irritability*. II. *Stamens and pistils of plants shew marks of sensibility*. III. *Vegetables possess some degree of volition*. IV. *Motions of plants are associated like those of animals*. V. 1. *Vegetable structure like that of animals, their anthers and stigmas are living creatures. Male-flowers of Vallisneria*. 2. *Whether vegetables possess ideas? They have organs of touch and smell, and ideas of external things?*

I. 1. THE fibres of the vegetable world, as well as those of the animal, are excitable into a variety of motion by the irritations of external objects. This appears particularly in the mimosa or sensitive plant, whose leaves contract on the slightest injury; the dionæa muscipula, which was lately brought over from the marshes of America, presents us with another curious instance of vegetable irritability; its leaves are armed with spines on their upper edge, and are spread on the ground around the stem; when an insect creeps on any of them in its passage to the flower or seed, the leaf shuts up like a steel rat-trap, and destroys its enemy. See Botanic Garden, Part II. note on Silene.[1]

The various secretions of vegetables, as of odour, fruit, gum, resin, wax, honey, seem brought about in the same manner as in the glands of animals: the tasteless moisture of the earth is converted by the hop-plant into a bitter juice; as by the caterpillar in the nut-

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shell the sweet kernel is converted into a bitter powder. While the power of absorption in the roots and barks of vegetables is excited into action by the fluids applied to their mouths like the lacteals[2] and lymphatics of animals.

2. The individuals of the vegetable world may be considered as inferior or less perfect animals; a tree is a congeries[3] of many living buds, and in this respect resembles the branches of coralline,[4] which are a congeries of a multitude of animals. Each of these buds of a tree has its proper leaves or petals for lungs, produces its viviparous[5] or its oviparous offspring in buds or seeds; has its own roots, which extending down the stem of the tree are interwoven with the roots of the other buds, and form the bark, which is the only living part of the stem, is annually renewed, and is superinduced upon the former bark, which then dies, and with its stagnated juices gradually hardening into wood forms the concentric circles, which we see in blocks of timber.

The following circumstances evince the individuality of the buds of trees. First, there are many trees, whose whole internal wood is perished, and yet the branches are vegete[6] and healthy. Secondly, the fibres of the barks of trees are chiefly longitudinal, resembling roots, as is beautifully seen in those prepared barks, that were lately brought from Otaheita.[7] Thirdly, in horizontal wounds of the bark of trees, the fibres of the upper lip are always elongated downwards like roots, but those of the lower lip do not approach to meet them. Fourthly, if you wrap wet moss round any joint of a vine, or cover it with moist earth, roots will shoot out from it. Fifthly, by the inoculation or engrafting[8] of trees many fruits are produced from one stem. Sixthly, a new tree is produced from a branch plucked from an old one, and set in the ground. Whence it appears that the buds of deciduous trees are so many annual plants, that the bark is a contexture[9] of the roots of each individual bud; and that the internal wood

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is of no other use but to support them in the air, and that thus they resemble the animal world in their individuality.

The irritability of plants, like that of animals, appears liable to be increased or decreased by habit; for those trees or shrubs, which are brought from a colder climate to a warmer, put out their leaves and blossoms a fortnight sooner than the indigenous ones.

Professor Kalm,[10] in his Travels in New York, observes that the apple-trees brought from England blossom a fortnight sooner than the native ones. In our country the shrubs, that are brought a degree or two from the north, are observed to flourish better than those, which come from the south. The Siberian barley and cabbage are said to grow larger in this climate than the similar more southern vegetables. And our hoards of roots, as of potatoes and onions, ge[r]minate with less heat in spring, after they have been accustomed to the winter's cold, than in autumn after the summer's heat.

II. The stamens and pistils of flowers shew evident marks of sensibility, not only from many of the stamens and some pistils approaching towards each other at the season of impregnation, but from many of them closing their petals and calyxes during the cold parts of the day. For this cannot be ascribed to irritation, because cold means a defect of the stimulus of heat; but as the want of accustomed stimuli produces pain, as in coldness, hunger, and thirst of animals, these motions of vegetables in closing up their flowers must be ascribed to the disagreeable sensation, and not to the irritation of cold. Others close up their leaves during darkness, which, like the former, cannot be owing to irritation, as the irritating material is withdrawn.

The approach of the anthers in many flowers to the stigmas, and of the pistils of some flowers to the anthers, must be ascribed to the passion of love, and hence belongs to sensation, not to irritation.

III. That the vegetable world possesses some degree of voluntary powers, appears from their necessity to sleep, which we have shewn in Sect. XVIII. to consist in the temporary abolition of voluntary

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power. This voluntary power seems to be exerted in the circular movement of the tendrils of vines, and other climbing vegetables; or in the efforts to turn the upper surface of their leaves, or their flowers to the light.

IV. The associations of fibrous motions are observable in the vegetable world, as well as in the animal. The divisions of the leaves of the sensitive plant have been accustomed to contract at the same time from the absence of light; hence if by any other circumstance, as a slight stroke or injury, one division is irritated into contraction, the neighbouring ones contract also, from their motions being associated with those of the irritated part. So the various stamina of the class of syngenesia have been accustomed to contract together in the evening, and thence if you stimulate one of them with a pin, according to the experiment of M. Colvolo,[11] they all contract from their acquired associations.

To evince that the collapsing of the sensitive plant is not owing to any mechanical vibrations propagated along the whole branch, when a single leaf is struck with the finger, a leaf of it was slit with sharp scissors, and some seconds of time passed before the plant seemed sensible of the injury; and then the whole branch collapsed as far as the principal stem: this experiment was repeated several times with the least possible impulse to the plant.

V. I. For the numerous circumstances in which vegetable buds are analogous to animals, the reader is referred to the additional notes at the end of the Botanic Garden, Part I. It is there shewn, that the roots of vegetables resemble the lacteal system of animals; the sap-vessels in the early spring, before their leaves expand, are analogous to the placental vessels of the fœtus; that the leaves of land-plants resemble lungs, and of those of aquatic plants the gills of fish; that there are other systems of vessels resembling the vena portarum of quadrupeds, or the aorta of fish;

that the digestive power of vegetables is similar to that of animals converting the fluids, which they

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absorb, into sugar; that their seeds resemble the eggs of animals, and their buds and bulbs their viviparous offspring. And, lastly, that the anthers and stigmas are real animals, attached indeed to their parent tree like polypi[12] or coral insects,[13] but capable of spontaneous motion; that they are affected with the passion of love, and furnished with powers of reproducing their species, and are fed with honey like the moths and butterflies, which plunder their nectaries. See Botanic Garden, Part I. add. note XXXIX.[14]

The male flowers of vallisneria approach still nearer to apparent animality, as they detach themselves from the parent plant, and float on the surface of the water to the female ones. Botanic Garden, Part II. Art. Vallisneria.[15] Other flowers of the classes of mon[o]ecia and di[o]ecia, and polygamia, discharge the fecundating farina,[16] which floating in the air is carried to the stigma of the female flowers, and that at considerable distances. Can this be affected by any specific attraction? or, like the diffusion of the odorous particles of flowers, is it left to the currents of winds, and the accidental miscarriages of it counteracted by the quantity of its production?

2. This leads us to a curious enquiry, whether vegetables have ideas of external things? As all our ideas are originally received by our senses, the question may be changed to, whether vegetables possess any organs of sense? Certain it is, that they possess a sense of heat and cold, another of moisture and dryness, and another of light and darkness; for they close their petals occasionally from the presence of cold, moisture, or darkness. And it has been already shewn, that these actions cannot be performed simply from irritation, because cold and darkness are negative quantities, and on that account sensation or volition are implied, and in consequence a sensorium[17] or union of their nerves. So when we go into the light, we contract the iris; not from any stimulus of the light on the fine muscles of the iris, but from its motions being associated with the sensation of too much light on the retina: which could not take

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place without a sensorium or center of union of the nerves of the iris with those of vision. See Botanic Garden, Part I. Canto 3. l. 440. note.

Besides these organs of sense, which distinguish cold, moisture, and darkness, the leaves of mimosa, and of dionæa, and of drosera, and the stamens of many flowers, as of the berbery,[18] and the numberous class of syngenesia, are sensible to mechanic impact, that is, they possess a sense of touch, as well as a common sensorium; by the medium of which their muscles are excited into action. Lastly, in many flowers the anthers, when mature, approach the stigma, in others the female organ approaches to the male. In a plant of collinsonia, a branch of which is now before me, the two yellow stamens are about three eights of an inch high, and diverge from each other, at an angle of about fifteen degrees, the purple style is half an inch,[19] high, and in some flowers is now applied to the stamen on the right hand, and in others to that of the left; and will, I suppose, change place to-morrow in those, where the anthers have not yet effused their powder.

I ask, by what means are the anthers in many flowers, and stigmas in other flowers, directed to find their paramours? How do either of them know, that the other exists in their vicinity? Is this curious kind of storge[20] produced by mechanic attraction, or by the sensation of love? The latter opinion is supported by the strongest analogy, because a reproduction of the species is the consequence; and then another organ of sense must be wanted to direct these vegetable amourettes to find each other, one probably analogous to our sense of smell, which in the animal world directs the new-born infant to its source of nourishment, and they may thus possess a faculty of perceiving as well as of producing odours.

Thus, besides a kind of taste at the extremities of their roots, similar to that of the extremities of our lacteal vessels, for the purpose of selecting their proper food; and besides different kinds of irritability

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residing in the various glands, which separate honey, wax, resin, and other juices from their blood; vegetable life seems to possess an organ of sense to distinguish the variations of heat, another to distinguish the varying degrees of moisture, another of light, another of touch, and probably another analogous to our sense of smell. To these must be added the indubitable evidence of their passion of love, and I think we may truly conclude, that they are furnished with a common sensorium belonging to each bud, and that they must occasionally repeat those perceptions either in their dreams or waking hours, and consequently possess ideas of so many of the properties of the external world, and of their own existence.

from Section XXXIX. Of Generation

from Section XXXIX.2.2–3 [Male and female roles in reproduction]

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2. That the embryon is secreted or produced by the male, and not by the conjunction of fluids from both male and female, appears from the analogy of vegetable seeds. In the large flowers, as the tulip, there is no similarity of apparatus between the anthers and the stigma: the seed is produced according to the observations of Spallanzani[21] long before the flowers open, and in consequence long before it can be impregnated, like the egg in the pullet. And after the prolific dust is shed on the stigma, the seed becomes coagulated in one point first, like the cicatricula of the impregnated egg. See Botanic Garden, Part I. additional note 38.[22] Now in these simple products of nature, if the female contributed to produce the new embryon equally with the male, there would probably have been some visible similarity of parts for this purpose, besides those necessary for the nidus[23] and sustenance of the new progeny. Besides in many flowers the males are more numerous than the females, or than the separate uterine cells in their germs, which would shew, that the office of the male was at least as important as that of the female; whereas if the female, besides producing the egg or seed, was to produce an equal part of the embryon, the office of reproduction would be unequally divided between them.

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Add to this, that in the most simple kind of vegetable reproduction, I mean the buds of trees, which are their viviparous offspring, the leaf is evidently the parent of the bud, which rises in its bosom, according to the observation of Linnæus. This leaf consists of absorbent vessels, and pulmonary ones, to obtain its nutriment, and to impregnate it with oxygene. This simple piece of living organization is also furnished with a power of reproduction; and as the new offspring is thus supported adhering to its father, it needs no mother to supply it with a nidus, and nutriment, and oxygenation; and hence no female leaf has existence.

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This paternal offspring of vegetables, I mean their buds and bulbs, is attended with a very curious circumstance; and that is, that they exactly resemble their parents, as is observable in grafting fruit-trees, and in propagating flower-roots; whereas the seminal offspring of plants, being supplied with nutriment by the mother, is liable to perpetual variation. Thus also in the vegetable class dioicia, where the male flowers are produced on one tree, and the female ones on another; the buds of the male trees uniformly produce either male flowers, or other buds similar to themselves; and the buds of the female trees produce either female flowers, or other buds similar to themselves; whereas the seeds of these trees produce either male or female plants. From this analogy of the production of vegetable buds without a mother, I contend that the mother does not contribute to the formation of the living ens[24] in animal generation, but is necessary only for supplying its nutriment and oxygenation.

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3. […] Those who have attended to the habits of the polypus, which is found in the stagnant water of our ditches in July,[25] affirm, that the young ones branch out from the side of the parent like the buds of trees, and after a time separate themselves from them. This is so analogous to the manner in which the buds of trees appear to be produced, that these polypi may be considered all male animals, producing embryons, which require no mother to supply them with a nidus, or with nutriment, and oxygenation.

This lateral or lineal generation of plants, not only obtains in the buds of trees, which continue to adhere to them, but is beautifully seen in the wires of knot-grass, polygonum aviculare, and in those of strawberries, fragaria vesca. In these an elongated creeping bud is protruded, and, where it touches the ground, takes root, and produces a new plant derived from its father, from which it acquires both nutriment and oxygenation; and in consequence needs no maternal apparatus for these purposes. In viviparous flowers, as those of alium magicum,[26] and polygonum viviparum,[27] the anthers and the stigmas become effete and perish; and the lateral or paternal offspring succeeds instead of seeds, which adhere till they are sufficiently mature, and then fall upon the ground, and take root like other bulbs.

The lateral production of plants by wires, while each new plant is

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thus chained to its parent, and continues to put forth another and another, as the wire creeps onward on the ground, is exactly resembled by the tape-worm, or tænia, so often found in the bowels, stretching itself in a chain quite from the stomach to the rectum. Linnæus asserts, "that it grows old at one extremity, while it continues to generate young ones at the other, proceeding ad infinitum, like a root of grass. The separate joints are called gourd-worms, and propagate new joints like the parent without end, each joint being furnished with its proper mouth, and organs of digestion." Systema naturæ. Vermes tenia.[28] In this animal there evidently appears a power of reproduction without any maternal apparatus for the purpose of supplying nutriment and oxygenation to the embryon, as it remains attached to its father till its maturity. The volvox globator, which is a transparent animal, is said by Linnæus to bear within it sons and grand-sons to the fifth generation.[29] These are probably living fetuses, produced by the father, of different degrees of maturity, to be detruded at different periods of time, like the unimpregnated eggs of various sizes, which are found in poultry; and as they are produced without any known copulation, contribute to evince, that the living embryon in other orders of animals is formed by the male-parent, and not by the mother, as one parent has the power to produce it.

This idea of the reproduction of animals from a single living filament of their fathers, appears to have been shadowed or allegorized in the curious account in sacred writ of the formation of Eve from a rib of Adam.

From all these analogies I conclude, that the embryon is produced solely by the male, and that the female supplies it with a proper nidus, with sustenance, and with oxygenation; and that the idea of the semen of the male constituting only a stimulus to the egg of the female, exciting it into life, (as held by some philosophers) has no support from experiment or analogy.

from Section XXXIX.4.8. [Evolution of organic life from "one living filament"]

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From thus meditating on the great similarity of the structure of the warm-blooded animals, and at the same time of the great changes they undergo both before and after their nativity; and by considering in how minute a portion of time many of the changes of animals above described have been produced; would it be too bold to imagine, that in the great length of time, since the earth began to exist, perhaps millions of ages before the commencement of the history of mankind, would it be too bold to imagine, that all warm-blooded animals have arisen from one living filament, which THE GREAT FIRST CAUSE endued with animality, with the power of acquiring new parts, attended with new propensities, directed by irritations, sensations, volitions, and associations; and thus possessing the faculty of continuing to improve by its own inherent activity, and of delivering down those improvements by generation to its posterity, world without end!

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Last of all the various tribes of vegetables are to be enumerated amongst the inferior orders of animals. Of these the anthers and stigmas have already been shewn to possess some organs of sense, to be nourished by honey, and to have the power of generation like insects, and have thence been announced amongst the animal kingdom in Sect. XIII. and to these must be added the buds and bulbs which constitute the viviparous offspring of vegetation. The former I suppose to be beholden to a single living filament for their seminal or amatorial procreation; and the latter to the same cause for their lateral or

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branching generation, which they possess in common with the polypus, tænia, and volvox; and the simplicity of which is an argument in favour of the similarity of its cause.

Linnæus supposes, in the Introduction to his Natural Orders, that very few vegetables were at first created, and that their numbers were increased by their intermarriages, and adds, suadent hæc Creatoris leges a simplicibus ad composita.[30] Many other changes seem to have arisen in them by their perpetual contest for light and air above ground, and for food or moisture beneath the soil. As noted in Botanic Garden, Part II. Note on Cuscuta.[31] Other changes of vegetables from climate, or other causes, are remarked in the Note on Curcuma in the same work.[32] From these one might be led to imagine, that each plant at first consisted of a single bulb or flower to each root, as the gentianella and daisy; and that in the contest for air and light new buds grew on the old decaying flower stem, shooting down their elongated roots to the ground, and that in process of ages tall trees were thus formed, and an individual bulb became a swarm of vegetables. Other plants, which in this contest for light and air were too slender to rise by their own strength, learned by degrees to adhere to their neighbours, either by putting forth roots like the ivy, or by tendrils like the vine, or by spiral contortions like the honeysuckle; or by growing upon them like the mistleto, and taking nourishment from their barks; or by only lodging or adhering on them, and deriving nourishment from the air, as tillandsia.

Shall we then say that the vegetable living filament was originally different from that of each tribe of animals above described? And that the productive living filament of each of those tribes was different originally from the other? Or, as the earth and ocean were probably peopled with vegetable productions long before the existence of animals; and many families of these animals long before other families of them, shall we conjecture, that one and the same kind of living filaments is and has been the cause of all organic life?

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The late Mr. David Hume,[33] in his posthumous works, places the powers of generation much above those of our boasted reason; and adds, that reason can only make a machine, as a clock or a ship, but the power of generation makes the maker of the machine; and probably from having observed, that the greatest part of the earth has been formed out of organic recrements; as the immense beds of limestone, chalk, marble, from the shells of fish; and the extensive provinces of clay, sandstone, ironstone, coals, from decomposed vegetables; all which have been first produced by generation, or by the secretions of organic life; he concludes, that the world itself might have been generated, rather than created; that is, it might have been gradually produced

from very small beginnings, increasing by the activity of its inherent principles, rather than by a sudden evolution of the whole by the Almighty fiat.—What a magnificent idea of the infinite power of THE GREAT ARCHITECT! THE CAUSE OF CAUSES! PARENT OF PARENTS! ENS ENTIUM![34]

For if we may compare infinities, it would seem to require a greater infinity of power to cause the causes of effects, than to cause the effects themselves. This idea is analogous to the improving excellence observable in every part of the creation; such as in the progressive increase of the solid or habitable parts of the earth from water; and in the progressive increase of the wisdom and happiness of its inhabitants; and is consonant to the idea of our present situation being a state of probation, which by our exertions we may improve, and are consequently responsible for our actions.

from Section XXXIX.5.2 [Sexual generation "the master-piece of nature"]

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The formation of the organs of sexual generation, in contradistinction to that by lateral buds, in vegetables, and in some animals, as the polypus, the tænia, and the volvox, seems the chef d'œuvre, the master-piece of nature; as appears from many flying insects, as in moths and butterflies, who seem to undergo a general change of their forms solely for the purpose of sexual reproduction, and in all other animals this organ is not complete till the maturity of the creature. Whence it happens that, in the copulation of animals of different species, the parts necessary to life are frequently completely formed; but those for the purpose of generation are defective, as requiring a nicer organization; or more exact coincidence of the particles of nutriment to the irritabilities or appetencies of the original living filament. Whereas those mules, where all the parts could be perfectly formed, may have been produced in early periods of time, and may have added to the numbers of our various species of animals, as before observed.

from Section XXXIX.6.1–2 ["The necessity of pleasurable sensation to copulation"]

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[1.] […] it would seem, that all the glands in the body have their secreted fluids affected, in quantity and quality, by the pleasurable or painful sensations, which produce or accompany those secretions. And that the pleasurable sensations arising from these secretions may constitute the unnamed pleasure of existence, which is contrary to what is meant by tædium vitæ, or ennui; and by which we sometimes feel ourselves happy, without being able to ascribe it to any mental cause, as after an agreeable meal, or in the beginning of intoxication.

Now it would appear, that no secretion or excretion of fluid is attended with so much agreeable sensation, as that of the semen; and it would thence follow, that the glands, which perform this secretion, are more likely to be much affected by their catenations[35] with pleasurable sensations. This circumstance is certain, that much more of this fluid is produced in a given time, when the object of its exclusion is agreeable to the mind.

2. A forceable argument, which shews the necessity of pleasurable sensation to copulation, is, that the act cannot be performed without it; it is easily interrupted by the pain of fear or

bashfulness; and no efforts of volition or of irritation can effect this process, except such as induce pleasurable ideas or sensations. […]

A curious analogical circumstance attending hermaphrodite insects, as snails and worms, still further illustrates this theory; if the snail or worm could have impregnated itself, there might have been a saving of a large male apparatus; but as this is not so ordered by nature, but each snail and worm reciprocally receives and gives impregnation, it appears, that a pleasurable excitation seems also to have been required.

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There is, however, another final cause, to which this circumstance may be imputed: it was observed above, that vegetable buds and bulbs, which are produced without a mother, are always exact resemblances of their parent; as appears in grafting fruit-trees, and in the flower-buds of the dioiceous plants, which are always of the same sex on the same tree; hence those hermaphrodite insects, if they could have produced young without a mother, would not have been capable of that change or improvement, which is seen in all other animals, and in those vegetables, which are procreated by the male embryon received and nourished by the female. And it is hence probable, that if vegetables could only have been produced by buds and bulbs, and not by sexual generation, that there would not at this time have existed one thousandth part of their present number of species; which have probably been originally mule-productions; nor could any kind of improvement or change have happened to them, except by the difference of soil or climate.

from Section XXXIX.8.1: Appendix (1801 ed.) [Revision of the "single filament" concept]

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VIII. 1. Since the former publication of the preceding Section on Generation, I have been induced in my treaties on Phytologia, to give more attention to the lateral or solitary generation of vegetables in the production of their buds, hoping from thence to throw some light on their sexual generation in the production of seeds; and in consequence on the propagation of more perfect animals, which I shall here relate, believing that it may interest the philosophical reader, observing only, that by the vegetable facts here attended to, I am now induced to believe, that the embryons of complicate animal and vegetable bodies are not formed from a single filament as above delivered; but that their structure commences in many parts at the same time, though it

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is probable, that the most simple or first exordium of animation was begun by a single filament, and continues to do so in the spontaneous production of the smallest microscopic animals, which do not appear to have been generated by other animalcula similar to themselves […]

from Section XXXIX.9.1: Appendix (1801 ed.) [Revision of male and female roles in generation]

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[…] from this analogy [of animal reproduction] to the lateral propagation of vegetable buds, if we suppose, that redundant fibrils with formative appetencies are produced by, or detached from, various parts of the male animal, and circulating in his blood, are secreted by adapted glands, and constitute the seminal fluid; and that redundant molecules with formative aptitudes or

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propensities are produced by, or detached from, various parts of the female, and circulating in her blood, are secreted by adapted glands, and form a reservoir in the ovary; and finally that when these formative fibrils, and formative molecules, become mixed together in the uterus, that they coalesce or embrace each other, and form different parts of the new embryon, as in the cicatricula of the impregnated egg; we may more readily comprehend some circumstances, which are difficult to understand on any other system of generation.

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[1] *LOTP* I:139n.

[2] Lymphatic vessels originating in the small intestine that carry chyle, a milky fluid. In *Zoonomia* Vol. 1, Section II, "Explanations and Definitions," ED writes of "the whole absorbent system, consisting of the lacteals, which open their mouths into the stomach and intestines, and of the lymphatics, which open their mouths on the external surface of the body, and on the internal linings of all the cells of the cellular membrane, and other cavities of the body" (1794 ed., Vol. 1, II.1.7, p. 9).

[3] A collection of things massed together.

[4] Organism resembling coral, such as seaweeds and plant-like compound animals.

[5] Viviparous: of animals, bringing forth young in a live state, in contrast to oviparous, bringing forth young in eggs; of plants, reproducing vegetatively from shoots, or reproducing offspring that germinate while attached to the parent plant.

[6] Healthy, vigorous, growing strongly.

[7] Tahiti.

[8] Grafting is to insert a shoot into a slit made in another stem or trunk; inoculation, also called budding, is to insert a bud from one woody plant under the bark of another.

[9] An interwoven structure.

[10] Swedish botanist Pehr Kalm (1716–1779) was a student of Linnaeus who travelled in England and North America collecting plant specimens. He shared his experiences in *En resa til Norra America* (1753–1761), translated as *Travels into North America* (1770–1771) by Johann Reinhold Forster (1729–1798), who was the naturalist on James Cook's second circumnavigation of the globe (1772–1775). ED's reference is found in the May 1749 section, Vol. 2, p. 167 of the English translation. ED also references this in *LOTP* I:322n.

[11] Giovambatista dal Covolo (1739–1768)*, Discorso della irritabilita d'alcuni fiori nuovamente scoperta* (1764), translated from the Italian by Benjamin Stillingfleet (1702–1771) as *A Discourse Concerning the Irritability of Some Flowers: A New Discovery* (1767). ED also references this in *LOTP* I:97n.

[12] ED describes the polypus as "found in the stagnant water of our ditches in July" (*Zoonomia* (1794 ed.), Vol. 1, XXXIX.2.3, p. 502). In his time the term encompassed several kinds of aquatic invertebrate of branched form.

[13] Coral polyps; individual animals of a coral zoophyte.

[14] *The Economy of Vegetation*, Additional Note XXXIX.—Vegetable Glandulation.
[15] *LOTP* I:393–406, I:395n.
[16] Pollen.
[17] In *Zoonomia*, Vol. 1, Section II, "Explanations and Definitions," ED writes, "The word *sensorium* in the following pages is designed to express not only the medullary part of the brain, spinal marrow, nerves, organs of sense, and of the muscles; but also at the same time that living principle, or spirit of animation, which resides throughout the body, without being cognizable to our senses, except by its effects. The changes which occasionally take place in the sensorium, as during the exertions of volition, or the sensations of pleasure or pain, are termed *sensorial motions*." (1794 ed., Vol. 1, II.2.1., p. 10).
[18] Barberry, Berberis vulgaris.
[19] Misplaced comma in original.
[20] Natural affection of parents for their offspring.
[21] Italian biologist Lazzaro Spallanzani (1729–1799) pursued a broad range of scientific research, and was particularly interested in reproduction. His *Dissertazioni di fisica animale e vegetabile,* published in Italian in 1780, was translated into English as *Dissertations relative to the Natural History of Animals and Vegetables* in 1784 by ED's friend, chemist and physician Thomas Beddoes (1760–1808). ED's reference is to Vol. 2, Dissertation 3, section 39, pp. 311–12.
[22] *The Economy of Vegetation* (1791), Additional Note XXVIII.—Vegetable Impregnation.
[23] A place where seeds, eggs, or other germinal matter can develop; a place of origin; a womb (from the Latin for nest).
[24] Being.
[25] In ED's time, the term "polypus" encompassed several kinds of aquatic invertebrates of branched form.
[26] Also known as Alium nigrum, black garlic or broadleaf garlic.
[27] Alpine bistort.
[28] The 1758 edition of Linnaeus's *Systema Naturæ* first includes Tænia. The quotation is a faithful translation of portions of Linnaeus's notes.
[29] Volvox is a fresh-water organism, now classified as algae or protozoa, whose cells form spherical, motile colonies. Volvox globator was the first species of the genus to be described (by Linnaeus in *Systema Naturæ* (1758 edition), which includes the remark on the generations loosely translated here by ED).
[30] Translated by ED as "This is evinced by the laws of the Creator, from simple to more compound," in *The Families of Plants* (1787; Vol. 2, p. 770).
[31] *LOTP* III:327n.
[32] *LOTP* I:65n.
[33] David Hume (1711–1776), philosopher and historian. ED refers to *Dialogues Concerning Natural Religion* (1779).
[34] Being of beings.
[35] Linking into a chain.