

SCIENTIFIC SECTION, AMERICAN PHARMACEUTICAL ASSOCIATION

VEGETABLE TAXONOMY.*

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The germs of botanical science are found in a rudimentary form in very remote antiquity. The beginning of a science may be considered to be that time when the subject to which it relates first engaged the thought and incited the investigations in regard to the particular natural phenomena by early mankind.

The actual achievements are not of material consideration in this connection; the fact that a subject became an object of study and speculation at a certain period constitutes the "germ" or "beginning" of the science, regardless of the question whether these early theories stood the test of time and were found correct, or whether they were afterwards abandoned because they were proved to be incorrect.

It can only be in this sense that it can be said truthfully that the germs of botanical science are traceable in remote antiquity.

Figuiet, in *Vegetable World*, says that the ancients already held the view that plants were sexual, and says this as if such ancient assumption was based on more or less scientific foundation. It is therefore of interest to examine the ancient views on sex, and this will show that Figuiet's assertion is erroneous and that the idea that the ancients *knew* plants to be sexual rests on very slim premises.

Primitive man probably at a very early period commenced to speculate on the origin or source of life. It is not inconceivable that the troglodytes living in their caves, depending for food on the hunt and chase, slaying wild animals in self-defence, others for game, robbing birds' nests for food, and using all animal products, even including the slain of their own kind, as provender, came across some eggs just as they were hatching, and generalizing from such observations, the egg became to them an early and primitive conception of the source of life and creation; and the "Cosmic Egg" became a feature of many mythologies and cosmogonies. From this egg originated our universe and all that it contains, including our earth, our gods, and men.

Appuleius, an ancient writer, "saw in the egg the symbol of all that was, that is, and that is possible to be"—and modern biology teaches that the ovum or egg is the highest manifestation of life, to which all other phenomena of life are subservient and contributory.

To civilized man only man seems personal—a real conscious *Ego*—"Cogito, ergo sum!" But savages, primitive men, conceive every object as being personal, endowed with passions and attributes like themselves; even the most abstract phenomena were regarded as persons—sky, earth, wind, fire, etc.

In the dim ages, before Linnæus, Berzelius, Cuvier and others had classified living beings and inanimate objects, the distinctions between animal, vegetable and inorganic objects were unknown. There were many transitional forms between animals and plants, on the one hand, while the fossils and petrifications

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furnished equally transitional forms between animals, vegetables and minerals on the other hand.

No ideas of sex were associated with the Cosmic Egg of the ancient cosmogonies. Brahma, who produced it according to the Brahminic traditions, was male; so was the Egyptian god Seb who produced it. The ovum was not recognized as a feminine characteristic. But mankind in its childhood imagined all things to be alive, and to have sex like mankind itself. All religions are based on sex; some, like the ancient Egyptian, Greek or Roman, or the Brahminic worship of Siva, very coarsely so; others, like the Christian, more obscurely so. But sex was the greatest mystery of the ancients, and also the readiest explanation for reproduction and life of any kind, and so all things, animate and inanimate, were supposed to be sexual and to produce either their own kind, or any other kind of being, by processes analogous to those by which human offspring was produced.

Even the soil and stones were supposed to be able to produce human beings, and the ancient Greeks called men who sprang from their soil "autochthones." Even our negroes, who still cultivate many features of voodoo worship, consider lodestones to be powerful fetiches or love-charms, and know how to distinguish between the "male" and "female" lodestones.

With such ideas prevailing, it was but natural that all living things, animal or vegetable, were considered to be related to each other, and that they all, like humankind, were male and female. And animals and plants came to be regarded as the ancestors of the human race, or at least of certain tribes or people. This is *totemism*.

While totemism generally considers man as descended from and therefore related to certain animals (totems), there are tribes who claim to be descended from and related to certain plants. Such tribes could not kill any animal for food or use any plant that was "totem" to them; such animal or plant was tapu (taboo) to them.

Among the Red Maize Clan of Omahas (N. A. Indians) the red maize was considered to be their totem or ancestor, and members of this tribe may not eat red maize.

Among the ancient Norsemen, Ygdrasil was the tree of life from which all living beings sprang. It reached with its roots to all parts of the earth, and produced all the inhabitants of the earth; its roots reached to the lowest depths of the under-world and produced the demons and evil spirits; and its branches reached up into the air, and produced all the creatures that live in the air, and its uppermost branches reached into heaven and produced the gods, thus binding all life into one relationship.

Ygdrasil was an ash-tree (*Fraxinus*) and was the ancestor (or the male ancestor) of mankind. "Fru Eller" (*Alder, Alnus*), according to Norse mythology, was the female progenitress, or ancestress, of mankind. Such and similar was the origin of the ancient belief that plants had sexual attributes. We will consider a few more of these ancient (and modern uncivilized) notions in regard to sex.

The Persians imagined the first tree and the first bull to have been the first ancestors of the human race; as the bull was their symbol of the male creator, the tree must have been their first female ancestress. They discovered, in physics generally, two antagonistic, or rather complementary, principles, one male, the other female.

Heaven and Earth (the deities Uranus and Gea) were at first united or hermaphrodite in many mythologies, under various names, but were afterwards

severed. Uranus (sky), overspreading Gea (earth), was supposed to be male and to be covering Gea in one unending sexual embrace.

In Maori mythology some of the gods were vegetable, some animal in nature. So also in Hindoo mythology.

Those of the people of Ambon who are descendants from trees may not use their totem trees for firewood.

An Ormon clan whose totem is the Kuj-rar tree will not eat of the oil obtained from that tree, nor even sit in its shade.

The *Eddas* say that the first man came from an ash-tree; the first woman from an alder-tree (the ash-tree a variety of *Fraxinus*; the alder-tree, *Alnus incana*, "Erle").

In making fire by friction a hole was made in a block of alder (yonic) and the stick which was twirled in this hole was of ash (phallic), the two by friction producing fire (heat and life).

The ancient Teutons considered the oak-tree male, because the acorn looks like a *glans penis* with its prepuce (acorn in its cupule).

A modern example of this method of grouping plants into male and female prevails in some rural districts of England, with regard to the holly (*Ilex aquifolium*). This plant is diœcious and the British Encyclopædia says that it changes sex from male to female with age.

The common people, however, distinguish two varieties of the plant; one variety which is prickly and rough and is called "he holly," the other variety, which is smooth or non-prickly, is "she holly," in analogy to the human body, which in the male is bearded and hairy on the body, while the female body is smooth and devoid of hair.

In some parts of Europe children are said to be found in lakes, from which they are brought by storks. In other parts they are said to grow on trees, or to be found in hollow trees.

The birch-tree (*Betula alba*) is considered to be feminine in Bavaria, and children are said to come from birch-trees, or to be found in hollow birch-trees. A newly-born girl-baby is bathed in a tub made of birch-wood so that when she grows up she will be attractive to the men.

The beech (*Fagus*) is considered also to be female, and in some provinces it is regarded in the same manner as the birch.

The *Lupercalia* were old Roman festivals on which occasions women ran about naked so that they could be whipped on their bare posteriors, to make them fertile. This festival survives in some primitive communities of continental Europe. Children are whipped with birch-switches ("Lebens-ruthen," life-switches), otherwise they will not thrive or grow, but remain stunted.

In many parts of Europe female domestic animals as well as the women of the household are whipped on the bare genitals with birch-switches on Halloween eve by the men of the household; this is supposed to insure fertility and healthy offspring.

In parts of Russia the husbands whip their wives on the bare posteriors with birch twigs to make them fertile and to insure easy and safe child-birth. A woman whose husband does not whip her thinks he does not love her. The trousseau of the bride contains the necessary bundle of birch rods or switches ("Ruthe"; also in German the name of the male virile organ).

In Poland, for the same reason, the bride is driven to the nuptial bed by the matrons with a rod of *fir*, which is there considered in the same way as the birch is elsewhere.

In Japan the fir is a symbol of the masculine; the plum-tree, of the feminine. At weddings dwarf trees of these two kinds are used as table decorations.

In India, when a Hindu plants a grove of mango trees, he will not take the fruit of the grove before the trees have been married (with full Brahminic rites and ritual) to some other kind of tree, usually a tamarind, sometimes an acacia. It is considered a disgrace if the mango trees commence to bear fruit before this marriage has been celebrated.

In the Punjab a Hindu cannot legally be married to a third woman; he gets around the difficulty by marrying a "babul" tree, so that the wife he subsequently marries is counted as his fourth.

In Bengal both bride and bridegroom are married to trees before they are married to each other.

Kipling wrote: "Lalun is a member of the most ancient profession in the world. In the West people say rude things about Lalun's profession and distribute lectures to young people in order that morality may be preserved. . . . Lalun's real husband, for even ladies of Lalun's profession in the East must have husbands; was a great big jujube-tree . . . for that is the custom of the land. The advantages of having a jujube-tree for a husband are obvious: you cannot hurt his feelings, he looks imposing, and he does not become jealous."

In Germany formerly, when a child was baptized, a "birth-tree" was planted; a male tree for a boy and a female tree for a girl; this was also done for one of President Wilson's grand-children.

According to Albertus Magnus (about 1250 A.D.), the trees used for this ceremonial were the pear-tree, which was masculine, and the apple-tree, which was feminine. The health and growth of the children were supposed to depend on the manner in which the tree thrived.

Among the ancient Greeks and Romans all trees that bore fruit were considered female; grammatically they were considered feminine, even if the names had masculine endings; the adjectives were feminine. In our scientific nomenclature we have retained this grammatical gender (or sex). *Prunus*, i. f., II Decl., plum-tree; as *Prunus domestica*, adj. fem. *Amygdalus*, i. f., II Decl., almond-tree; as *Amygdalus communis*, var. *amara*, adj. fem. *Quercus*, us, fem. IV Decl., oak-tree; as *Quercus infectoria*, adj. fem.

This applies also to many smaller plants, although not as regularly so: *Avena sativa*, fem.; *Oryza sativa*, fem.

But enough for the present of plant folk-lore; it shows that no element of a scientific nature entered into the widespread ancient belief that plants were sexual in their natures.

Of course, sex was more distinctly apparent in animals and mankind, but even here, the ideas as to the sexual process were vague and wholly unscientific. In fact, the earliest references, in the oldest mythologies, did not always assume two complementary principles or agencies (sometimes spoken of as "antagonistic principles"), but seem to have taught that the Creator was of hermaphrodite nature. I have already stated that in early cosmogonies the Cosmic Egg was not associated with a feminine or not even with any sexual agency.

In New Zealand, Chinese, Vedic, Indian and Greek myths Heaven (sky) and Earth constituted a hermaphrodite being; their union was perpetual. Only later on were they considered as a pair, or as unisexual and dual.

The *Purana*, a sacred Brahminic book, says: "The Supreme Spirit, in the act of creation, became twofold; the right side was male, the left was Prakriti. She is Maia, eternal and imperishable." Again: "The Divine Cause of Creation

experienced no bliss, being isolated—alone. He ardently desired a companion; and immediately the desire was gratified. He caused his body to divide and became male and female. They united and human beings were thus made."

In imitation of this ancient theory that the Creator was androgynous or hermaphrodite some philosophers held the same view with regard to Jehovah (or Elohim), the god of the Bible. We read in the twenty-seventh verse of the first chapter of Genesis: "So God created man *in his own image; male and female created he them.*" And this is emphasized by repetition in the more explicit statement in verses 1 and 2, Gen., ch. v: "In the day that God created man, in the likeness of God made he them; and God blessed them, and *called their name Adam.*"

The Talmud (Hebrew Traditions) says that Adam was created androgynous. His head reached the clouds. God caused a sleep to fall on him, and took something away from all his members, and these parts he fashioned into ordinary men and women, and scattered them through the world.

After Lilith, Adam's first wife, mother of demons and giants, deserted him, God separated Adam into his two sexual parts; he took one of Adam's ribs and made Eve from it.

Philo, a Jewish philosopher contemporaneous with Jesus, said that Adam was a double, androgynous or hermaphrodite being "in the likeness of God." Philo said that "God separated Adam into his two sexual component parts, one male, the other female—Eve—taken from his side. The longing for reunion, which love inspired in the divided halves of the originally dual being, is the source of the sexual pleasure, which is the beginning of all transgressions."

Plato, a Greek philosopher, explained the amatory instincts and inclinations of men and women by the assertion that human beings were at first androgynous; Zeus separated them into unisexual halves, and they seek to become reunited.

The Aryans of India account for the appearance of the different animals in this way: "Purusha was alone in the world. He differentiated himself into two beings, man and wife. The wife regarded union with him as incest and fled, assuming the shapes of various animals. The husband pursued, taking the same shapes, and thus produced the various species of animals."

We read in Genesis (ch. ii, v. 7), "And the Lord formed man of the dust of the ground and breathed into his nostrils the breath of life; and man became a living soul." And Job said (xxxiii, 4), "The spirit of God hath made me and the breath of the Almighty hath given me life."

The "breath of God" was recognized as the vivifying, life-giving, fertilizing essence of the Creator, not only by the early Jewish religion, but also by other religions of antiquity.

Many ancient authors believed in the "out-breathing" (*halitus*) of the male being the fecundating agent that produced life. In mediæval times it was held that Mary was made pregnant by the "word of God" (a very slight modification of the "breath of God") because the Bible tells us that "the word became flesh."

Pythagoras (500 B.C.) taught that "seed is an immaterial ether or vapor, similar to thought, produced by the male." And even as late as A.D. 1600, Caesalpinus, an Italian scientist, referred to a "*halitus*" or breath (an immaterial emanation, exhalation or vapor—practically the perfume) from the male plants as causing fertility in the female plants. But a material substance, or "seed," was substituted for the "breath" at a very early age.

Anaxagoras (a Greek philosopher, about 500 B.C.) taught that the embryo was formed entirely from the "seed" of the father and that the mother merely

furnished the soil in which it grew and developed. But this theory was not new. Anaxagoras merely gave it more definite expression, and made it generally known and popular among the Greeks and the successors to Greek science. The earliest traces of this theory are found in the religious writings of archaic times. For more than a thousand years the sacred compositions of the Hebrews and the Hindus (the Old Testament and the Rig-Vedas) were transmitted orally in Southwestern Asia, and from the resulting folk-lore were obtained the contents of the Bible and the Rig-Vedas when these "books" were reduced to writings, and in both of these sacred books we find this theory, which was taught by Aristotle and Diogenes of Apollonia, but which is most generally ascribed to Anaxagoras, plainly stated.

In the ancient marriage ceremony of the Hindus, when the bride enters her husband's home, those present say: "As a fallow field thy wife enters; sow in her, O man, thy seed!"

And in the Bible we read (Gen. xxx, 11, about 1732 B.C.), "God said unto Jacob, Israel shall be thy name. . . . *Kings shall come out of thy loins*" ("loins" in this connection being a euphemistic translation of the Hebrew word meaning phallus or genitals). And again (Gen. xlvi, v. 26, about 1706 B.C.): "All the souls that came with Jacob into Egypt, *which came out of his loins* . . . were three score and ten."

This passage from the Bible is of considerable interest in connection with the theory of the "preformationists," who held not only that the fully formed although microscopically minute organism existed preformed in the seed of the father, but that it contained or included in itself (like a nest of pill-boxes one within the other) all subsequent generations of germs as well.

This view seems to be implied in the statement just quoted from Genesis, that the children and the children's children "came out of the loins" of Jacob. Again (about 1004 B.C.), the Lord said unto David: "Nevertheless thou shalt not build the house (the temple) but *thy son that shall come forth out of thy loins*, he shall build the house unto my name" (I Kings, ix, 19). The Bible therefore teaches this theory. As late as A.D. 64, this theory had Biblical sanction, for St. Paul referred to a time before Levi was born in this wise: "*For he was yet in the loins of his father Jacob*" (Hebr. vii, 5).

And such was the authority of the Bible that this view persisted until quite modern times. Charles Bonnet taught that before fecundation the germ is pre-existent, and that it contains in miniature all the organs of the adult. His book, "*Contemplation de la Nature*," containing these teachings was published in 1764-1765. Bonnet died in 1793.

Leeuwenhoek, in 1677, made known his discovery of the spermatozoa. Dr. Dalen Patius soon afterwards claimed to have seen the human form in the spermatozoön, "the two naked thighs, the legs, the breast, both arms, etc."

In France, in 1694, Hartsoecker published that "each spermatozoön conceals beneath its tender and delicate skin a complete male or female animal. The egg (of the woman) is merely the source of nourishment for the real germ contained in the spermatozoön. Each one of the male animals (spermatozoa) encloses an infinity of other animals, both male and female, which are correspondingly small, and those male animals enclose yet other males and females of the same species, and so forth in a series which are to be produced up to the end of time." And the scientists of those days seriously calculated when the supply of germs which Adam had deposited in Eve, and through her in mankind, would become exhausted, and how many human beings were preformed in the beginning and came "from the loins" of Adam. Buffon, the celebrated scientist, and the friend of Bonnet, held similar views.

So it appears that this view of the male furnishing the "seed" was predominant from about 1732 B.C. to the beginning of the nineteenth century, or, if we include the centuries of the oral transmission of the Bible, for about 4000 years.

Some ancient views:

Pythagoras, 500 B.C.—"Semen is an immaterial substance, like thought, produced by the male."

Alkmaeon.—"Both sexes gave seed; who gave most determined the sex of the offspring."

Anaxagoras, 500-426 B.C.—"The embryo is from the male only; a drop from the brain."

Democritus, 470-369 B.C.—"Seed is produced from all parts of the man's body."

Aristotle, 384-322 B.C.—"Seed is produced only by the male; it causes coagulation of the menstrual blood and this coagulum forms the embryo."

Diogenes of Appollonia.—"The embryo is formed from the seed of the male."

Then there was a long list of authors, generally referred to as "post-Pythagorean" philosophers, Thessalus, Drakon, Polybius, Dioxippus, Diokles, and others, who believed in accord with many ancient phallic religions that the male "seeds" were formed in the right testicle (on) and the female "seeds" were formed in the left testicle (hoa); they believed the sex of the offspring could be controlled by tying a string around one of the testicles during coition. A string tied around the right testicle prevented the male seeds from escaping, so that a seed from the left testicle would produce a girl child; and *vice versa*, by tying a string around the left testicle and allowing only seed from the right testicle to be emitted, a boy must necessarily be the result. Galen (130-200 A.D.) also taught this theory. Mohammed considered the seed to be merely fluid; in the Koran, Sura xcvi, he said: "Read, in the name of the Lord who created man from a drop!"

In Cruden's Concordance of the Bible, the first edition of which was published in 1737, but the edition which I have, and from which I quote, printed in 1829, we find the following definition of seed: "Seed—that thin, hot and spirituous humour in man's body which is fitted by nature for the generation of mankind (Gen. 38,9). Likewise for that matter which in all plants and fruits is disposed for the propagation of the kind."

The oldest mention of botanical lore was found in Assyrian and Egyptian inscriptions. In a tomb at Thebes a wall-painting was found which represents a botanical garden, and this is the earliest mention of the cultivation of exotic plants. A contemporary record on a temple wall at Thebes states that an expedition was sent by Queen Hasop (about 1600 B.C.) to bring incense trees from Punt (modern Somaliland) to be planted in the gardens connected with the temple for the purpose of cultivating incense for the temple ceremonials.

An early attempt at botanical illustration is a Babylonian sculpture (about 680 B. C.) showing Ashurbanipal's queen at a meal; among the plants in the background are a date palm and a grapevine, both of which are quite characteristically depicted.

In Sardanapal's library (650 B.C.) were figured plants and plant parts used in medicine, which were stated to be copied from inscriptions going back to between 4000 and 5000 B.C.

The promoters of botany among the ancient Greeks and Romans were not, properly speaking, botanists, but *rhizotomæ* or *pharmacopolæ*, gatherers of medicinal roots and herbs. Aristotle, Mithridates, Cato, Virgil, Dioscorides and the elder Pliny, however, all wrote on botany or the wonders of vegetation. The most learned and important works on this subject were the works of Theophrastus

(fourth century B.C.). He mentions sexuality of plants, but did not determine any special sexual organs.

Of course it may have been empirically noted at a quite early time that some plants never bore fruit, while others of the same kind did produce fruit. The ancients considered fruit-bearing plants as female by analogy with mankind or themselves; the plants that did not produce fruit were therefore male. Some dioecious plants, like hemp, were of this kind; so were date palms; and this empirical observation led the ancients to speak of male and female plants without their having any real scientific understanding of the facts.

The works of Theophrastus remained the most important works on botany until comparatively recent times, in fact, until the times of Linnæus and his contemporaries.

Herodotus, who wrote about 450 years B.C., recorded that the female date-trees had to be fertilized by shaking among their flower-clusters the flower-clusters from the male trees. This procedure, as just explained, must have been due to empirical experience and not to scientific understanding, and the fertilizing power was even ascribed to the multitude of small gnats that were shaken out of the male clusters of flowers.

Alpini, a physician and botanist who lived 1553-1617, wrote: "The female date-palms do not bear fruits unless the branches of the male and female plants are mixed together; or, as is more generally done, unless the dust found in the male sheath or male flower is sprinkled over the female flowers." There does not appear any reason to place Alpini's opinion on other than purely empiric experience.

When alchemists realized the futility or absurdity of their search for the "philosopher's stone" which was to transmute baser metals to gold, or for the "elixir of life" which would cure all diseases and prolong life indefinitely, they turned their attention to the solving of the mystery of generation; the mystery of Adam and Eve, the "red man" and the white woman of Genesis in the Bible.

Caesalpinus (1519-1603), a learned Italian scientist, published a work entitled *De Plantis Libri xvi*, in 1583. In this work the author suggested a classification of plants which more or less distinctly foreshadowed both the Linnæan system and the Natural system of Jussieu and which he based on characteristics of flowers, stamens, pistils and fruits. In this work he recognized that plants were sexual, but he speaks of the "halitus" (breath, exhalation, perfume?) as the fertilizing agent. His views on the anthers and pistils, however, do not seem to have become generally known nor generally accepted.

In the year 1682 Nehemiah Grew, secretary of the Society of London, published his *Anatomy of Plants*, in which the nature of the stamens and pistils as the male and female organs of plants was distinctly asserted.

In 1694 Camerarius, a German botanist, also described the stamens as male organs and the pistils as female organs, in a book entitled *De Sexu Plantarum*.

In 1684 the French botanist Tournefort published his *Elements of Botany*, being the first attempt to define the exact limits of genera in vegetables. Most of his genera are still recognized in modern classifications. The great mistake of his classification, however, was his division of all plants into two classes, "Trees and Herbs"; the great merit, on the other hand, was the importance given to the study of the flower.

His scheme in outline is as follows :

Flower-bearing trees:

Apetalous	{	Apetalous, properly so called
		Amentacæ, having catkins
Petalous	{	Monopetalous
		Polypetalous { Regular, Rosacæ Irregular, Papilionacæ

Herbaceous plants without corolla:

1. Plants provided with stamens (wheat, barley, rice, etc.).
2. Flowerless plants with seeds (ferns, lichens, etc.).
3. Plants in which flowers and fruits are not apparent.

Simple-flowering herbaceous plants:

Corolla monopetalous	{	Regular
		Irregular
Corolla polypetalous	{	Regular
		Irregular

Compound flowering herbaceous plants:

Compositæ.

While Caesalpinus, Grew and Camerarius had promulgated the idea that plants possessed sexual parts, Tournefort remained sceptical and did not accept such views. However, his system of classification was so superior to previous systems that it brought order where confusion had previously existed, and modern scientific botany practically originated with Tournefort.

John Ray, an English botanist, published his *Historia Plantarum* in 1686; in this work he laid the foundations for modern natural systems of classification.

The main plan of Ray's system is as follows:

Plants	{	Flowerless plants	{	Monocotyledonous
		Flowering plants		Dicotyledonous

Divided into woody trees and herbaceous plants.

Further subdivisions based on the fruits.

In 1735 Linnæus presented the theory that stamens were male organs and pistils female organs of plants with such convincing emphasis that he compelled universal acceptance of this view. So little known, apparently, were the previously published views of Caesalpinus, Grew and Camerarius, that Linnæus is generally considered to have been the first one to explain the nature of stamens and pistils and to firmly establish the fact that plants have sex. He rendered the theory popular by basing on it his system of classification, which is even to this day used in the schools in some European lands. While modifications of Ray's system constitute the Natural systems of modern times, the Linnæan system still forms an artificial key to the Natural systems, and the terms of this system are generally used in the description of plants and flowers.

That this demonstration of the sexual nature of plants was novel is seen from the interest, even enthusiasm, with which it was received. Erasmus Darwin, the grandfather of Charles Darwin, published a poem, "The Loves of the Flowers," which was illustrated with a series of fine steel engravings; and the rapid acceptance of the Linnæan system everywhere is generally known.

In 1789 Laurent de Jussieu published his *Genera Plantarum*, which is the basis of all modern natural systems of classification; we thus bring down the history of taxonomy to our own times.

During the last 75 or 100 years many botanists have attempted various systems of classification based on the consideration of the cotyledons; of polypetalous, monopetalous and apetalous flowers; upon the mode of insertion of the stamens; names have changed, things remain the same; and if in their details the series of families or orders present certain differences it only arises from the fact that a linear series is incompatible with the natural system, and that the connection of the intermediate groups may be expressed in various ways without affecting the general principles of the system.

While Linnæus established the main facts of the nature of the sexual organs in plants, the exact method of fertilization remained as obscure as that in the case of animals. The pollen was recognized as the matter which fecundated the ovary, but it remained a question as to the manner in which it did so.

It was at first thought that the grains of pollen broke on the stigmas and that the granules were absorbed by the stigma and went to form the embryo. In 1823 Amici, an Italian botanist, discovered the pollen-tubes. About 1837 Schleiden and Hœckel announced that the vegetable embryo preëxisted as a germ within the pollen grains; it is carried at the end of the pollen-tube to the embryonic sac, where it develops into the seed or embryo.

Whether this was a *conscious* effort to harmonize the fertilization of plants with the views held so long in regard to animals and man, views that were apparently in harmony with the teachings of the Bible, that the seed or embryo issued from the sexual parts of the male, or father, I cannot say; that it was such there can be no doubt.

Schleiden's theory of the preëxistence of the embryo in the pollen grains was shown to be wrong by the observations of Brongniart, Amici, Muhl, Unger, Hoffmeister, and others.

In 1849 Tulasne published his studies on vegetable embryogeny and finally established the theory of fertilization as taught to-day, namely, that the male and female elements unite to form the embryo.

About 1876 the nuclear theory of fertilization was demonstrated. The successive steps in karyokinesis and the importance of chromosomes were demonstrated.

This does not mean that all the secrets of the process are clear; hundreds of men of science are still trying to solve further mysteries of heredity, etc., but these mysteries, while constituting the most fertile field for research and investigation, do not particularly interest us now in connection with this attempt to fix the niche which is filled by Linnæus in connection with the development of Vegetable Taxonomy.
