Dyestuffs: bodies used to impart color to textile fibers and fabrics. Many colors exist already formed in plants: others are produced from colorless bodies by oxidation or other processes. Lakes are compounds of coloring-matters with metallic oxides, such as alumina, the oxides of tin, lead, antimony, and barium. They are generally prepared from cochineal, alizarin, weld, Brazil-wood, aniline colors, etc. (See LAKES.) The following are some of the most important dyestuffs of animal and vegetable origin:

I. ANIMAL DYES.—*Cochineal*, the female insect of the species *Coccus cacti*, is by far the most important. Its coloring principle is carminic acid. It produces scarlets and crimsons of great brilliancy on silk and wool. Carmine is nearly pure carminic acid. *Kermes*, *kermes grains*, *alkermes* is the insect *Coccus ilicis*, one of the most ancient dyes for red shades on silk. *Lac* is the *Coccus laccæ*, a similar insect. The *Tyrian purple* was obtained from mollusks, and is no longer used. *Galls* are excrescences produced on the leaves and leaf-stalks of the oak by punctures of the gall-wasp, made for the purpose of depositing her eggs. Their characteristic constituent is tannic acid, which produces drabs and blacks with iron salts. They also serve as a mordant for some aniline colors, and are the basis of most writing-inks. *Sepia* is the fluid of cuttlefish; it is not used as a dye, but as a water-color by artists. *Murexide* is a purple compound produced by the action of nitric acid and ammonia on uric acid from guano; it is no longer used.

II. VEGETABLE DYES.—These are extremely numerous, although only a few are in general use. They are derived from different parts of plants: (1) From roots the most important is *madder* (*Rubia tinctorum*), which contains two principles, alizarin and purpurin. These bodies produce on cotton the most permanent reds, purples, and chocolates, which makes them specially applicable for calico-printing. Madder appears in commerce in the form of ground root; garancin, the ground root boiled with sulphuric acid and washed; and extract, a tolerably pure alizarin. The use of madder as a dyestuff has nearly ceased, and it has been replaced by alizarin manufactured artificially from the anthracene of coal-tar. *Munjeet* is the Indian madder. *Alkanet* is the *Anchusa tinctoria*, formerly used for lilac, lavender, and purple on silk. Its colors were always fugitive. *Barberry* produces a yellow of little importance. *Turmeric*, the tuber of *Curcuma tinctoria*, or Indian saffron, produces a fugitive yellow. It is now chiefly used for yellow lacquers, as a test for alkalies, for mixing with curry-powder and with mustard, and in dyeing wool. *Soorangee* is a yellow much used in India. (2) Among the more important woods are *logwood*, containing hæmatoxylin, extensively used for reds, purples, violets, blues, and blacks; *Brazil-wood*, comprising several species of *Cæsalpinia*, found in Central and South America and in Japan, known as Lima, Pernambuco, Santa Martha, Peach, Nicaragua, Sapan or Japan, etc. It yields a coloring-matter known as brazilin, which produces rich reds. *Sandal-wood*, from Ceylon, and *camwood* or *barwood*, from Africa, contain santalin, which gives reds, violets,

and scarlets. *Fustic*, or yellow wood, is the *Morus tinctoria* from the West Indies. *Fustet*, young fustic, or Hungarian yellow wood, is the *Rhus cotinus*. (3) The only bark of special importance is the *quercitron* from the *Quercus tinctoria*, which contains quercitron and produces a rich yellow, and greens when combined with blue; a pulverized preparation made from it is known as florine. *Lu-kao*, or *Chinese green*, is a green lake prepared by the Chinese from the bark of a species of *Rhamnus*, or buckthorn. (4) Leaves of the *Rhus cotinus* are known as *sumach*; they produce a yellow, but are generally used, on account of the tannic acid they contain, either as a mordant or to produce blacks, etc., with iron salts. *Chica*, which gives an orange on cotton, consists of the leaves of *Bignonia chica*. (5) *Flowers.* The petals of *Carthamus tinctorius* constitute safflower. They contain a useless yellow coloring-matter, soluble in water, and a beautiful pink (*carthamin*), soluble in alkalies. *Saffron*, a beautiful yellow dye, consists of the stigmas of *Crocus sativus*. (6) *Fruit.* Persian, French, Turkey, etc., berries are derived from several species of *Rhamnus*. They contain a beautiful yellow dye (*chrysorhamnine*) and olive yellow (*xanthorhamnine*). They are used in calico-printing, for paper pulp, and for lakes. *Annatto* or *annotto* is an extract of the seed-pellicles of *Bixa orellana*. It is used for yellows, oranges, and with reds for scarlet. It is also employed for coloring butter and cheese. *Divi-divi* is the pod of the *Cæsalpinia coriaria*. It contains tannic acid. *Catechu*, *terra japonica*, and *gambir* are the extracts prepared from the fruit, wood, twigs, and unripe pods of several plants growing in India. Their active principle, as well as that of *divi-divi*, is a species of tannic acid. They are used as mordants, with iron salts for drabs and blacks, and in tanning skins; catechu and gambir furnish browns. (7) *Entire plants. Indigo* from various species of the *Indigofera*, and *woad* from the *Isatis tinctoria*, contain a glucoside (*indican*) which by fermentation yields indigo blue (*indigotine*). This color has long been used as one of the most permanent blue dyes. Several preparations are employed by the dyer: (*a*) solution of colorless or reduced indigo, with which the cloth or yarn is impregnated, and from which the insoluble blue indigotine is precipitated on exposure to the air; (*b*) in solution in sulphuric acid as sulpho-purpuric acid, purple blue, or as sulpho-indigotic acid, deep blue; (*c*) as carmine of indigo, or extract, the soda compounds of the above-mentioned acids, usually the sodium salt of indigo-disulphonic acid. It is used for cotton, silk, and wool, and in calico-printing. *Lichens.* A variety of lichens yield, by a kind of oxidation, a series of products known as *archil* or *orchil*, *cudbear* or *persio*, and *litmus*. The weeds (from the Canaries, the Pyrenees, etc.) are pulverized and moistened with urine, when certain acids they contain are changed to the coloring-matter *orcein*. Archil appears in commerce as a purple paste, cudbear as a red powder, litmus as a blue lake. Before the introduction of the aniline colors the most beautiful purples for silk were obtained from archil. *Weld*, the *Reseda luteola*, contains lutioline, which yields a rich but fugitive yellow. Extracts containing the coloring-matters in concentrated form are prepared from most of the dye-woods, and are found in trade in the liquid or solid form.

III. Artificial or Chemical Colors.—(1) Pigments are insoluble metallic compounds, either produced in the yarn or cloth by successively applying the necessary reagents, or attached mechanically to the surface by albumen or other adhesive substances. *Prussian blue* is a ferrocyanide of iron; *chrome yellow* and *orange* are chromates of lead; *Schweinfurt green* is the aceto-arsenite of copper; *Guignet's green* is a hydrated oxide of chromium; *ultramarine* is a compound of alumina, silica, soda, and sulphur. (2) *Coal-tar colors* which have become equal to if not more important than the natural ones. The consumption of these colors is rapidly increasing in the tinctorial arts. This entirely new class of dyestuffs, the creation of modern chemistry, is derived from the refuse tar produced in gas-works from bituminous coal. The colors belong to four distinct series: (*a*) The aniline series, including the red rosaniline salts, the purple, violet, and blue substitution products derived from them, the greens, yellows, browns, black, and pinks, all of which are described under Aniline Colors (*q. v.*). (*b*) The phenol or carbolic acid series, including picric acid, and other nitro-coloring matters, the eosines, coerulein, etc. (See Phenol Colors.) (*c*) The azo-coloring-matters, chrysoidine, Bismarck brown, the tropæolins, the numerous wool scarlets, and the benzidine or tetrazo-colors. (*d*) Anthracene series, of which artificial alizarin anthrapurpurin, alizarin orange, anthracene blue, etc., are the representatives. See Anthracene, Alizarin, and Madder.

All the important animal and vegetable dyestuffs above mentioned are described more fully under their respective titles. For fuller information, consult the works on dyeing mentioned in the article on Dyeing.

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Revised by L. M. Norton.