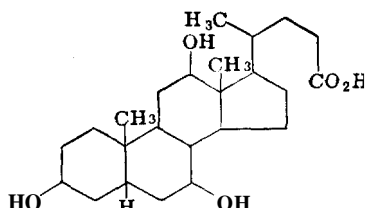


**cholic acid.** CAS: 81-25-4.  $C_{23}H_{49}O_3COOH$ .



The most abundant bile acid. In bile, it is conjugated with the amino acids glycine and taurine as glycocholic acid and taurocholic acid, respectively, and does not occur free.

Properties: The monohydrate crystallizes in plates from dilute acetic acid. Bitter taste with sweetish aftertaste. Anhydrous form, mp 198°C. Not precipitated by digitonin. Soluble in glacial acetic acid, acetone, and alcohol; slightly soluble in chloroform; practically insoluble in water and benzene.

Derivation: From glycocholic and taurocholic acids in bile; organic synthesis.

Grade: FCC.

Use: Biochemical research, pharmaceutical intermediate, emulsifying agent in foods (up to 0.1%).

**choline.** (choline base;  $\beta$ -hydroxyethyltrimethylammonium hydroxide).

CAS: 62-49-7.  $(CH_3)_3N(OH)CH_2CH_2OH$ .

Member of the vitamin B complex. Essential in the diet of rats, rabbits, chickens, and dogs. In man it is required for lecithin formation and can replace methionine in the diet. There is no evidence of disease in man due to choline deficiency. It is a dietary factor important in furnishing free methyl groups for transmethylation; has a lipotropic function.

Source: Egg yolk, kidney, liver, heart, seeds, vegetables, and legumes; synthetic preparation from trimethylamine and ethylene chlorohydrin or ethylene oxide.

Properties: Viscous, alkaline liquid; soluble in water and alcohol. Amounts are expressed in milligrams of choline.

Use: Medicine, nutrition, feed supplement, catalyst, curing agent, control of pH, neutralizing agent, solubilizer.

**choline bicarbonate.** See hydroxyethyltrimethylammonium bicarbonate.

**choline bitartrate.**  $(C_5H_{14}NO)C_4H_5O_6$ .

Properties: White, crystalline powder; odorless or faint trimethylamine-like odor; acid taste; hygroscopic; soluble in water and alcohol; insoluble in ether, chloroform, and benzene.

Grade: FCC.

Use: Medicine, dietary supplement, nutrient.

**choline chloride.** CAS: 67-48-1.

$(CH_3)_3N(Cl)CH_2CH_2OH$ . Animal-feed additive derived from agricultural waste or made synthetically. Available as 50% dry feed-grade and 70% solution.

**Cholinesterase.** (1) (acetylcholinesterase) Enzyme specific for the hydrolysis of acetylcholine to acetic acid and choline in the body. It is found in the brain, nerve cells, and red blood cells, and is important in the mechanism of nerve action.

See nerve gas; parathion; insecticide.

Derivation: From bovine erythrocytes.

Use: Biochemical research, determination of phosphorus in insecticides and poisons.

(2) "Pseudo" or nonspecific cholinesterase, prepared from horse serum. This esterase hydrolyzes other esters as well as choline esters. It occurs in blood serum, pancreas, and liver.

**cholinesterase inhibitor.** A chemical compound which deactivates the enzyme cholinesterase, thus preventing or retarding hydrolytic breakdown of the highly toxic acetylcholine formed in the body by the nervous system. Nerve gases act in this way, and so do a number of insecticides, usually organic esters of phosphoric acid derivatives. Serious poisoning and death may occur on ingestion or prolonged inhalation of such compounds. Cholinesterase can be reactivated by administration of atropine sulfate or pralidoxime iodide.

See also parathion, nerve gas.

**cholytaurine.** See taurocholic acid.

**chondroitin sulfate.** A major constituent of the cartilaginous tissue in the body.

**chondrus.** See carrageenan.

**chorionic gonadotropin.** (HCG). A hormone isolated from blood and urine of pregnant women; it is secreted by the placenta. It is a glycoprotein containing approximately 11% galactose and having a molecular weight of approximately 100,000.

Properties: Rods or needle-like crystals. Soluble in water and glycols. Unstable in aqueous solution, stable in dry form. It enhances estrone and progesterone production.

Units: One international unit equals the activity of 0.1 mg of a standard preparation.

Use: Medicine, veterinary medicine.

**"Chromecyl" [Du Pont].** TM for a group of dyes that contain chromium in the molecule. Suitable for wool and nylon.

**chromate.** Compound in which chromium has a valency of six.

**chromated zinc chloride.** See zinc chloride, chromated.

**chromaticity.** A qualitative description of color based on hue and saturation independent of brilliance.

**chromaticity coordinates.** The ratios of each tristimulus value of a color to sum of tristimulus values.

**chromatic scale.** The arrangement of the colors of the visible spectrum.

**chromatin.** A deoxyribonucleoprotein complex consisting of (1) double-stranded DNA molecules, (2) a basic protein called histone, and (3) other proteins. The latter protect the DNA from attack by enzymes. Chromatin occurs in the cell nucleus, where it forms chromosomes, the carriers of genes. Its name is derived from its sensitivity to biological stains.

See also deoxyribonucleic acid, chromosome, gene.

**chromatogram.** A column of adsorbent gas or liquid carrying bands or zones of adsorbed molecules.

See: Chromatography.

**chromatography.** A group of laboratory separation techniques based on selective adsorption by which components of complex mixtures (vapors, liquids, solutions) can be identified. Its discoverer, Tswett (1906), named the procedure chromatography because the plant pigments used in his early experiments produced bands of characteristic color. Since the 1930s, the method has been widely applied in many variations to the analysis of colorless mixtures such as hydrocarbons, metallic salts, etc. Separation is due to redistribution of the molecules of the mixture between the thin phase (adsorption layer) and the bulk phase (adsorbent) with which it is in contact. As the thin phase sometimes approaches molecular dimensions, the size and shape of the molecules of the mixture are of great significance.

Chromatography involves the flow of a mobile (gas or liquid) phase over a stationary phase (which may be a solid or a liquid). Liquid chromatography is used for soluble substances, and gas (vapor-phase) chromatography for volatile substances. As the mobile phase moves past the stationary phase, repeated adsorption and desorption of the solute occurs at a rate determined chiefly by its ratio of distribution between the two phases. If the ratio is large enough, the components of the mixture will move at different rates, producing a series of bands (chroma-

tographs) by which their identity can be determined.

See also liquid chromatography, gas chromatography, paper chromatography, thin-layer chromatography, ion-exchange chromatography, gel filtration.

**chrome alum.** See chromium potassium sulfate.

**chrome ammonium alum.** See chromium ammonium sulfate.

**chrome cake.** A green form of salt cake (sodium sulfate) containing a low percentage of chromium. A by-product of sodium dichromate manufacture used in the paper industry.

**chrome dye.** A mordant dye, most frequently one in which sodium dichromate is used as the mordant.

**chrome green.** See chrome pigment.

**chrome liquor.** A solution of basic chromic salt used in chrome tanning. It usually is a strong solution of sodium dichromate treated with sulfur dioxide or glucose and sulfuric acid.

**chrome-molybdenum steel.** Steel, made by any accepted method of quality steel-making, containing both chromium and molybdenum, usually in the ranges of chromium 0.35-1.10% and molybdenum 0.08-0.35%.

**chrome-nickel steel.** See steel, stainless.

**chrome orange.** Basic lead chromate.  
Use: In pigments.

**chrome pigment.** An inorganic pigment containing chromium. The most important types are: (1) chrome oxide green, one of the most permanent and stable pigments known, the pure grade consisting of 99% Cr<sub>2</sub>O<sub>3</sub>, used in paints applied to cement and lime-containing surfaces; (2) chrome green, chrome yellow, and chrome red, consisting chiefly of lead chromate and used in paints, rubber, and plastic products; (3) miscellaneous pigments such as molybdate orange and zinc yellow, based on lead and zinc compounds of chromium, respectively. All these are more stable to sunlight, weathering, and chemical action than the brighter organic dyes.

Hazard: Toxic by ingestion.

**chrome potash alum.** See chromium potassium sulfate.

**chrome red.** See chrome pigment.

**chromesteel.** A steel, made by any accepted method of quality steel-making, containing chromium as alloying element, usually in the range 0.20-1.60%, although the content may be as high as 25% in specialized heat-resistant and wear-resistant steels and in stainless steels. See also steel, stainless.

**chrome tanning.** See tanning.

**chrome-vanadium steel.** A steel, made by any accepted method of quality steel-making, containing both chromium and vanadium, usually in the ranges of chromium 0.50-1.10% and vanadium 0.10-0.20%.

**chrome yellow.** See lead chromate, chrome pigment.

**chromia.** See chromic oxide.

**chromic.** Designating compounds in which the chromium is positive trivalent.

**chromic acetate.** (chromium acetate). CAS: 1066-30-4.  $\text{Cr}(\text{C}_2\text{H}_3\text{O}_2)_3 \cdot \text{H}_2\text{O}$ . Properties: Grayish-green powder or bluish-green, pasty mass. Soluble in water, insoluble in alcohol. Derivation: Action of acetic acid on chromium hydroxide. The solution is evaporated and crystallized. Hazard: Toxic by ingestion. Use: Textile mordant, tanning, polymerization and oxidation catalyst, emulsion hardener.

**chromic acid.** (chromium trioxide; chromic anhydride). CAS: 7738-94-5.  $\text{CrO}_3$ . The name is in common use although the true chromic acid,  $\text{H}_2\text{CrO}_4$ , exists only in solution. Properties: Dark purplish-red crystals; soluble in water, alcohol, and mineral acids. Deliquescent; d 1.67-2.82; mp 196°C. Derivation: (1) Sulfuric acid is added to a solution of sodium dichromate and the product is crystallized out; (2) chromite is fused with soda ash and limestone and then treated with sulfuric acid; (3) electrolysis. Grade: Technical, CP. Hazard: Powerful oxidizing agent, may explode on contact with reducing agents, may ignite on contact with organic materials. A poison. Corrosive to skin. TLV: 0.05 mg/m<sup>3</sup> of air. A human carcinogen. Use: Chemicals (chromates, oxidizing agents, catalysts), chromium-plating intermediate, medicine (caustic), process engraving, anodizing, ceramic glazes, colored glass, metal cleaning, inks, tanning, paints, textile mordant, etchant for plastics.

**chromic bromide.**  $\text{CrBr}_3$ . Properties: Black crystals, soluble in boiling water, insoluble in cold water unless chromous salts are added. Derivation: Passage of bromine vapor over pulverized chromium at 1000°C. Use: Olefin polymerization catalyst.

**chromic chloride.** (chromium chloride; chromium trichloride; chromium sesquichloride). CAS: 10025-73-7. (1)  $\text{CrCl}_3$  or (2)  $\text{CrCl}_3 \cdot 6\text{H}_2\text{O}$ . Properties: (1) Violet crystals, d 1.76, mp 1150°C, sublimes at approximately 1300°C. Insoluble in water and alcohol. (2) Greenish-black or violet deliquescent crystals, depending on whether or not chlorine is coordinated with the chromium, d 1.76, mp 83°C. Soluble in water and alcohol, insoluble in ether. Derivation: (1) By passing chlorine over a mixture of chromic oxide and carbon. (2) By the action of hydrochloric acid on chromium hydroxide. Hazard: A poison. TLV: 0.5 mg/m<sup>3</sup> in air. Use: Chromium salts, intermediates, textile mordant, chromium plating including vapor plating, preparation of sponge chromium, catalyst for polymerizing olefins, waterproofing.

**chromic fluoride.** (chromium fluoride; chromium trifluoride). CAS: 7788-97-8.  $\text{CrF}_3 \cdot 4\text{H}_2\text{O}$  or  $\text{CrF}_3 \cdot 9\text{H}_2\text{O}$ . Properties: Fine, green crystals; d (anhydrous): 3.8; mp 1000°C; bp (sublimes) 1100-1200°C. Insoluble in water and alcohol, soluble in hydrochloric acid. Derivation: Interaction of chromium hydroxide and hydrofluoric acid. Grade: Technical, high purity ( $\text{CrF}_3$ ). Hazard: Irritant to skin and eyes, especially in solution. TLV: 0.5 mg/m<sup>3</sup> of air. Use: Printing and dyeing woolens, mothproofing, halogenation catalyst.

**chromic hydroxide.** (chromic hydrate; chromium hydroxide; chromium hydrate).  $\text{Cr}(\text{OH})_3$ . Properties: Green, gelatinous precipitate; decomposes to chromic oxide by heat. Insoluble in water, soluble in acids and strong alkalies. Derivation: By adding a solution of ammonium hydroxide to the solution of a chromium salt. Use: Guignet's green, catalyst, tanning agent, mordant.

**chromic nitrate.** (chromium nitrate). CAS: 13548-38-4.  $\text{Cr}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$ . Properties: Purple crystals, soluble in alcohol and water, mp 60°C, decomposes 100°C. Derivation: By the action of nitric acid on chromium hydroxide.

Hazard: May ignite organic materials on contact; may be explosive when shocked or heated; powerful oxidizer. Very toxic.  
Use: Catalyst, corrosion inhibitor.

**chromic oxide.** (chromium(III) oxide; chromia; chromium sesquioxide; green cinnabar).  
CAS: 1308-38-9.  $\text{Cr}_2\text{O}_3$ .

Properties: Bright green, extremely hard crystals; d 5.2; mp 2435°C; bp 4000°C; insoluble in water, acids, and alkalis.

Derivation: (1) By heating chromium hydroxide, (2) by heating dry ammonium dichromate, (3) by heating sodium dichromate with sulfur and washing out the sodium sulfate.

Hazard: Toxic by ingestion and inhalation. TLV: 0.5 mg/m<sup>3</sup> of air.

Use: Metallurgy, green paint pigment, ceramics, catalyst in organic synthesis, green granules in asphalt roofing, component of refractory brick, abrasive.

**chromic phosphate.** (chromium phosphate).  
CAS: 7789-04-0.

(1)  $\text{CrPO}_4 \cdot 6\text{H}_2\text{O}$ ; (2)  $\text{CrPO}_4 \cdot 4\text{H}_2\text{O}$ .

Properties: (1) Violet crystals, d 2.12 (14C); (2) green crystals, soluble in acids, insoluble in water.

Derivation: (1) Interaction of solutions of chromium chloride and sodium phosphate; (2) by mixing chrome alum and disodium hydrogen phosphate. Violet, amorphous powder (not the hexahydrate) is formed which becomes crystalline on contact with water. On boiling, it is converted into green crystalline hydrate.

Use: Paint pigment, catalyst.

**chromic sulfate.** (chromium sulfate).  
CAS: 10101-53-8.

(1)  $\text{Cr}_2(\text{SO}_4)_3$ ; (2)  $\text{Cr}_2(\text{SO}_4)_3 \cdot 15\text{H}_2\text{O}$ ;  
(3)  $\text{Cr}_2(\text{SO}_4)_3 \cdot 18\text{H}_2\text{O}$ .

Properties: (1) Violet or red powder; (2) dark green amorphous scales; (3) violet cubes. D (1) 3.012; (2) 1.867; (3) 1.70. (1) Insoluble in water and acids; (2) soluble in water, insoluble in alcohol; (3) soluble in water and alcohol.

Derivation: Action of sulfuric acid on chromium hydroxide with subsequent crystallization.

Use: Chrome plating, chromium alloys, mordant, catalyst, green paints and varnishes, green ink, ceramics (glazes). The basic form (reduction of sodium dichromate) is used in tanning.

**chrominance.** The colorimetric difference between any color and a reference color of equal luminance, the reference color having a specific chromaticity.

**chromite.** (chrome iron ore).

CAS: 1308-31-2.  $\text{FeCr}_2\text{O}_4$ . A natural oxide of ferrous iron and chromium, sometimes with

magnesium and aluminum present. Usually occurs in magnesium and iron-rich igneous rocks. Properties: Color iron-black to brownish-black, streak dark brown, luster metallic to submetallic, d 3.6, Mohs hardness 5.5.

Grade: Metallurgical, refractory, chemical.

Occurrence: USSR, South Africa, Zimbabwe, Philippines, Cuba, Turkey.

Hazard: A carcinogen. TLV: 0.05 mg/m<sup>3</sup> of air.

Use: Only commercial source of chromium and its compounds.

**chromium.** CAS: 7440-47-3. Cr. Metallic element of atomic number 24, group VIB of the periodic table, aw 51.996, valences of 2, 3, 6; 4 stable isotopes. Name derived from Greek for color.

Properties: Hard, brittle, semi-gray metal; d 7.1; mp 1900°C; bp 2200°C. Compounds have strong and varied colors. Cr ion forms many coordination compounds. Exists in active and passive forms, the latter giving rise to its corrosion resistance due to a thin surface oxide layer that passivates the metal when treated with oxidizing agents. Active form reacts readily with dilute acids to form chromous salts. Soluble in acids (except nitric) and strong alkalis, insoluble in water.

Occurrence: USSR, South Africa, Turkey, Philippines, Zimbabwe, Cuba.

Derivation: From chromite by direct reduction (ferrochrome), by reducing the oxide with finely divided aluminum or carbon, and by electrolysis of chromium solutions.

Grade: (ore) Chromium ores are classified as (1) metallurgical, (2) refractory, and (3) chemical, and their consumption in the U.S. is in that order. (1) Must contain a minimum of 48%  $\text{Cr}_2\text{O}_3$  and have Cr-Fe ratio of 3:1; (2) must be high in  $\text{Cr}_2\text{O}_3$  and  $\text{Al}_2\text{O}_3$  and low in iron; (3) must be low in  $\text{SiO}_2$  and  $\text{Al}_2\text{O}_3$  and high in  $\text{Cr}_2\text{O}_3$ .

Forms available: (1) Chromium metal as lumps, granules, or powder; (2) high- or low-carbon ferrochromium; (3) single crystals, high-purity crystals, or powder run 99.97% pure.

Hazard: Hexavalent chromium compounds are carcinogenic (OSHA) and corrosive on tissue, resulting in ulcers and dermatitis on prolonged contact. TLV: For chromium dust and fume is 0.5 mg/m<sup>3</sup> of air.

Use: Alloying and plating element on metal and plastic substrates for corrosion resistance, chromium-containing and stainless steels, protective coating for automotive and equipment accessories, nuclear and high-temperature research, constituent of inorganic pigments.

**chromium-51.** Radioactive chromium of mass number 51.

*Hawley's*  
*Condensed Chemical*  
*Dictionary*

**TWELFTH EDITION**

*Revised by*  
**Richard J. Lewis, Sr.**



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