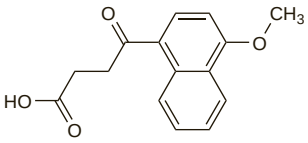
Menbutone *(BAN, rINN)*

Menbuton; Menbutona; Menbutoni; Menbutonum; SC-1749 (menbutone sodium). 4-(4-Methoxy-1-naphthyl)-4-oxobutyric acid.

Менбутон

$C_{15}H_{14}O_4$ = 258.3.
CAS — 3562-99-0.
ATC Vet — QA05AX90.

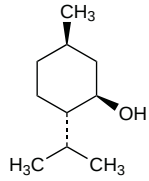


Profile
Menbutone is used as a choleretic to stimulate gastrointestinal function in veterinary medicine.

Menthol

Hexahydrothymol; Mentholum; Mentol; Mentoli; Mentolis. *p*-Menthan-3-ol; 2-Isopropyl-5-methylcyclohexanol.

$C_{10}H_{20}O$ = 156.3.
CAS — 1490-04-6 (menthol); 15356-60-2 ((+)-menthol); 2216-51-5 ((–)-menthol); 89-78-1((±)-menthol).



Description. Menthol is either the laevo-isomer, levomenthol (*BAN*, *rINN*), or a racemic mixture, racementhol (*BAN*, *rINN*). The laevo-isomer may be obtained from the volatile oils of various species of *Mentha* (Labiatae) or it may be prepared synthetically.

Pharmacopoeias. In *Chin.*, *Eur.* (see p.vii), *Jpn*, *US*, and *Viet. Eur.* and *Jpn* have separate monographs for laevo-menthol (levomenthol) and racemic menthol (racementhol).

Ph. Eur. 6.2 (Levomenthol). It occurs as colourless, acicular or prismatic shiny crystals. M.p. about 43°. Practically insoluble in water; very soluble in alcohol and in petroleum spirit; freely soluble in fatty oils and in liquid paraffin; very slightly soluble in glycerol.

Ph. Eur. 6.2 (Menthol, Racemic; Racementhol BP 2008). It occurs as colourless, acicular or prismatic shiny crystals or as a free-flowing or agglomerated crystalline powder. M.p. about 34°. Practically insoluble in water; very soluble in alcohol and in petroleum spirit; freely soluble in fatty oils and in liquid paraffin; very slightly soluble in glycerol.

USP 31 (Menthol). An alcohol obtained from diverse mint oils or prepared synthetically. It may be laevorotatory (*l*-menthol), from natural or synthetic sources, or racemic (*dl*-menthol). It occurs as colourless, hexagonal crystals, usually needle-like, or in fused masses, or crystalline powder. Has a pleasant, peppermint-like odour. M.p. of *l*-menthol 41° to 44°. Slightly soluble in water; very soluble in alcohol, in chloroform, in ether, and in petroleum spirit; freely soluble in glacial acetic acid, in fixed and volatile oils, and in liquid paraffin. Store in airtight containers preferably at a temperature of 15° to 30°.

Compounding. A liquid or soft mass is formed when menthol is triturated with camphor, cloral hydrate, phenol, and many other substances.

Methods of preparing menthol 1% w/w in aqueous cream BP and the stability of the resultant product have been discussed.[1]

1. Cable C. The preparation of menthol (1 per cent w/w) in aqueous cream BP. *Pharm J* 2005; **274:** 469.

Adverse Effects, Treatment, and Precautions
Menthol may give rise to hypersensitivity reactions including contact dermatitis. Ingestion of significant quantities of menthol is reported to cause symptoms similar to those seen after ingestion of camphor (p.2273), including severe abdominal pain, nausea, vomiting, vertigo, ataxia, drowsiness, and coma; they may be managed similarly. There have been reports (below) of apnoea and instant collapse in infants after the local application of menthol to their nostrils.

Administration to infants. Instillation of decongestant preparations containing menthol directly into the nostrils of infants and young children has resulted in acute respiratory distress with cyanosis[1] and respiratory arrest,[2] and must be avoided. In one case,[1] nasal application was associated with concurrent chemical conjunctivitis.

1. Wyllie JP, Alexander FW. Nasal instillation of 'Olbas Oil' in an infant. *Arch Dis Child* 1994; **70:** 357–8.
2. Blake KD. Dangers of common cold treatments in children. *Lancet* 1993; **341:** 640.

Effects on the nervous system. Ataxia, confusion, euphoria, nystagmus, and diplopia developed in a 13-year-old boy following the inhalation of 5 mL of Olbas oil instead of the recommended few drops.[1] It was considered probable that the menthol in the preparation was responsible for the symptoms; the amount of menthol inhaled was approximately 200 mg.

1. O'Mullane NM, *et al*. Adverse CNS effects of menthol-containing Olbas oil. *Lancet* 1982; **i:** 1121.

Pharmacokinetics
After absorption, menthol is excreted in the urine and bile as a glucuronide.

Absorption. The systemic absorption of camphor, menthol, and methyl salicylate from dermal patches containing all three ingredients has been studied.[1] The absolute bioavailability of these compounds could not be determined from this study, but there did not appear to be any substantial systemic accumulation even after unrealistically high exposure for prolonged periods.

1. Martin D, *et al*. Dermal absorption of camphor, menthol, and methyl salicylate in humans. *J Clin Pharmacol*. 2004; **44:** 1151–7.

Uses and Administration
Menthol is chiefly used to relieve symptoms of bronchitis, sinusitis, and similar conditions. For this purpose it may be used as an inhalation, usually with benzoin or eucalyptus oil, as pastilles, or as an ointment with camphor and eucalyptus oil for application to the chest or nostrils (but see Adverse Effects above). However, as mentioned under the section on the management of cough (p.1547), the use of menthol in inhalations is unlikely to provide any additional benefit.

When applied to the skin menthol dilates the blood vessels, causing a sensation of coldness followed by an analgesic effect. It relieves itching and is used in creams, lotions, or ointments in pruritus and urticaria. It has also been applied to the forehead, presumably as a counter-irritant, for the relief of headache.

In small doses by mouth menthol has a carminative action.

Action. It has been suggested that the apparent benefits of menthol in nasal congestion may be due to an effect on calcium channels of sensory nerves.[1] This mechanism has also been implicated in its muscle relaxant action on the gastrointestinal tract when used as peppermint oil (p.1761).

1. Anonymous. How does menthol work? *Pharm J* 1993; **251:** 480.

Preparations
BP 2008: Levomenthol Cream; Menthol and Benzoin Inhalation;
USP 31: Benzocaine and Menthol Topical Aerosol; Menthol Lozenges; Tetracaine and Menthol Ointment.

Proprietary Preparations (details are given in Part 3)
Arg.: Flex-All; Rati Salil Ice; Robitussin Caramelos†; ***Austral.:*** Dencorub Arthritis Ice; Ice Gel; Vicks Throat Drops†; Vicks Vapodrops with Butter and Menthol; ***Braz.:*** Analgen†; ***Canad.:*** Absorbine Jr.; Absorbine Jr Roll-on Ice; Absorbine Power Gel; Antiphlogistine Rub A-535 Ice; Bengay Ice†; Bentasil†; Certified Ice; Cough Drops; Cough Lozenges; Deep Cold; Fisherman's Friend; Flex-All; Ice Gel Therapy; Ice Gel†; Meggezones†; Physiomenthol; Polar Ice; Soothing Ice Rub; Vicks Throat Drops; ***Chile:*** Friorub; Hielorub; Mentholatum Patch; ***Ger.:*** Klosterfrau Franzbranntwein Menthol; Nifint†; ***Hong Kong:*** Counterpain; ***India:*** Dolocide Plus; ***Indon.:*** Counterpain Cool; ***Malaysia:*** Menzza Ice; ***Mex.:*** Friocal†; ***NZ:*** Vicks Throat Drops; Vicks Vapodrops; ***Pol.:*** Deep Relief†; Migrenol; ***Port.:*** Vicks Vaporub; ***Singapore:*** Celatrac; Counterpain Cool; ***Spain:*** Prulit; ***Switz.:*** Perskindol Cool; ***Thai.:*** Centropain; Counterpain Cool; Painza Cool; Stopain; ***UK:*** Arjun; Deep Freeze Cold Gel; Dermacool; Happinose; Ice Cool Stress & Tension Relief; Meggezones; Quool; Vicks Vaposyrup for Tickly Coughs; ***USA:*** Absorbine Jr; Ben-Gay Patch; Ben-Gay Vanishing; Cepacol Sore Throat Post Nasal Drip; Extra Strength Vicks Cough Drops; Halls-Plus Maximum Strength; Icy Hot Back Pain Relief; Icy Hot Pop & Peel; Icy Hot Pro-Therapy; Kof-Eze; Mineral Freez Gel; N'ice; N'ice 'n Clear; Salonpas Aqua Patch; Sportscreme Ice; Therapeutic Mineral Ice; Therapy Ice; Vicks Cough Drops; Wonder Ice; ***Venez.:*** Dencorub Ice; Inquifric†.

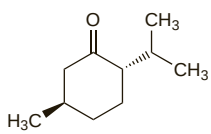
Multi-ingredient: numerous preparations are listed in Part 3.

Menthone

(±)-menthone; (*dl*)-menthone; Menton. (2*R*,5*S*)-*rel*-5-Methyl-2-(1-methylethyl)cyclohexanone; .

Ментон

$C_{10}H_{18}O$ = 154.2.
CAS — 3391-87-5 ((+)-menthone); 14073-97-3 ((–)-menthone); 89-80-5 ((±)-menthone); 1196-31-2 ((+)-isomenthone); 491-07-6 ((±)-isomenthone);.



((–)-menthone)

Profile
Menthone is a constituent of several essential oils. Of the 4 possible stereoisomers of menthone, (–)-menthone (*l*-menthone) is the most abundant in nature. Menthone is reported to be a cholagogue and has been used in preparations for biliary-tract and liver disorders.

Preparations
Proprietary Preparations (details are given in Part 3)
Multi-ingredient: ***Austria:*** Rowachol; ***Braz.:*** Quelodin†; ***Cz.:*** Rowachol; ***Ger.:*** Rowachol; Rowachol comp†; Rowachol-Digestiv; ***Hong Kong:*** Neo-Rowachol; Rowachol; ***Hung.:*** Rowachol; ***Irl.:*** Rowachol; ***Israel:*** Rowachol; ***Malaysia:*** Rowachol; ***Mex.:*** Cholex; ***Philipp.:*** Rowachol; ***Pol.:*** Rowachol; Terpichol; ***Switz.:*** Rowachol; ***Thai.:*** Rowachol; ***UK:*** Rowachol; ***Venez.:*** Rowachol.

Menyanthes

Bitterklee; Bogbean; Buckbean; Folia Trifoli Fibrini; Liść bobrka (bogbean leaf); Marsh Trefoil; Ményanthe; Menyanthidis Folium (bogbean leaf); Menyanthidis trifoliatae folium; Raatteenlehti (bogbean leaf); Trébol de agua; Trèfle d'Eau; Trifolii Fibrini Folium (bogbean leaf); Trilapių pupalaiškių lapai (bogbean leaf); Vachtový list (bogbean leaf); Vattenklöverblad (bogbean leaf); Vidrafűlevél (bogbean leaf).

NOTE. Bog myrtle (see p.2267) has also been used as a common name for *Menyanthes trifoliata*.

Pharmacopoeias. In *Eur.* (see p.vii).

Ph. Eur. 6.2 (Bogbean Leaf). The dried, entire or fragmented leaf of *Menyanthes trifoliata*. It has a very bitter and persistent taste.

Profile
Menyanthes has been used as a bitter. It is used in herbal medicine for rheumatic, gastrointestinal, and biliary-tract disorders. It is also used in folk medicine.

Homoeopathy. Menyanthes has been used in homoeopathic medicines under the following names: Menyanthes trifoliata; Menyan. t.

Preparations
Proprietary Preparations (details are given in Part 3)
Cz.: List Vachty Trojliste†.

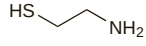
Multi-ingredient: ***Austria:*** Mariazeller; ***Cz.:*** Naturland Grosser Swedenbitter†; ***Fr.:*** Tisane Hepatique de Hoerdt; ***Ger.:*** Gallexier; ***Pol.:*** Krople Zoladkowe; ***Rus.:*** Original Grosser Bittner Balsam (Оригинальный Большой Бальзам Биттнера); ***UK:*** Modern Herbals Rheumatic Pain; Rheumatic Pain; Rheumatic Pain Relief; Rheumatic Pain Remedy; Vegetex.

Mercaptamine *(BAN, rINN)*

Cysteamine *(USAN)*; L-1573; MEA; Mercamine; Mercaptamina; Mercaptaminum; Merkaptamiini; Merkaptamin. 2-Aminoethanethiol.

Меркаптамин

C_2H_7NS = 77.15.
CAS — 60-23-1.
ATC — A16AA04.
ATC Vet — QA16AA04.



NOTE. In the UK, the CSM noted in October 2004 that confusion had arisen between mercaptopurine (p.744) and mercaptamine (formerly cysteamine) after the switch from prescribing by British Approved Name to prescribing by International Nonproprietary Name. Particular care should be taken to distinguish the two, since they are available in oral dosage forms of similar strength.

Mercaptamine Bitartrate *(BANM, rINNM)*

Bitartrato de mercaptamina; Cysteamine Bitartrate; Mercaptamine, Bitartrate de; Mercaptamini Bitartras.

Меркаптамина Битартрат

C_2H_7NS, $C_4H_6O_6$ = 227.2.
CAS — 27761-19-9.
ATC — A16AA04.
ATC Vet — QA16AA04.

Mercaptamine Hydrochloride *(BANM, rINNM)*

Cl-9148; Cysteamine Hydrochloride *(USAN)*; Hidrocloruro de mercaptamina; Mercaptamine, Chlorhydrate de; Mercaptamini Hydrochloridum.

Меркаптамина Гидрохлорид

C_2H_7NS,HCl = 113.6.
CAS — 156-57-0.
ATC — A16AA04.
ATC Vet — QA16AA04.

Adverse Effects and Precautions
Mercaptamine can be unpalatable and may cause breath and body odour. It may cause gastrointestinal disturbances including anorexia, nausea, vomiting, diarrhoea, and abdominal pain, and occasionally, gastrointestinal ulceration. Other adverse effects may include drowsiness, lethargy, headache, rashes, fever, and encephalopathy. Mercaptamine may cause increases in liver en-

zyme values, and there have been some reports of nephrotic syndrome. Nervousness and, sometimes, hallucinations, have also been reported.

Intolerance. Three patients with nephropathic cystinosis developed fever, maculopapular eruption, leucopenia, or headache within 2 weeks of starting mercaptamine at doses of 53, 67, and 75 mg/kg daily by mouth, respectively.[1] These adverse effects resolved within 48 hours of drug withdrawal and all 3 patients were able to tolerate mercaptamine when restarted at a dose of 10 mg/kg daily, slowly increased to therapeutic levels over 2 to 3 months. Higher doses of mercaptamine had been associated with lethargy and seizures.

1. Schneider JA, *et al.* Cysteamine therapy in nephropathic cystinosis. *N Engl J Med* 1981; **304:** 1172.

Pharmacokinetics

◊ Results of a pharmacokinetic-pharmacodynamic study[1] in paediatric patients with nephropathic cystinosis showed that although mercaptamine is rapidly cleared from plasma, dosing every 6 hours was sufficient to maintain the content of cystine in the white blood cells below the target value (see below).

1. Belldina EB, *et al.* Steady-state pharmacokinetics and pharmacodynamics of cysteamine bitartrate in paediatric nephropathic cystinosis patients. *Br J Clin Pharmacol* 2003; **56:** 520–5.

Uses and Administration

Mercaptamine reduces intracellular cystine levels and is given orally as the bitartrate in the treatment of cystinosis (see below); it has also been given as the hydrochloride. Doses are expressed in terms of the base; 2.94 g of the bitartrate or 1.47 g of the hydrochloride are each equivalent to 1 g of mercaptamine. Mercaptamine bitartrate is given in an initial dose that is one-sixth to one-quarter of the expected maintenance dose, and is then increased gradually over 4 to 6 weeks. The usual maintenance dose in adults weighing over 50 kg is 2 g daily in 4 divided doses with or after food. Children up to 12 years of age are given 1.3 g/m^2 (approximately 50 mg/kg) daily in 4 divided doses. Doses are given in conjunction with monitoring of leucocyte-cystine levels which should be kept below 1 nanomol of hemicystine per mg of protein.

Phosphocysteamine, a phosphorothioester of mercaptamine, has been said to be more palatable, and is used similarly.

Mercaptamine facilitates glutathione synthesis and was formerly used intravenously in the treatment of severe paracetamol poisoning to prevent hepatic damage, but other forms of treatment are now preferred (see p.108).

Cystinosis. Mercaptamine and phosphocysteamine (which appears to be rapidly hydrolysed to mercaptamine after ingestion) have been reported to be of benefit in children with cystinosis, a rare autosomal recessive metabolic disorder characterised by the intracellular accumulation of cystine. Cystinosis is marked by growth retardation, rickets, Fanconi syndrome, and renal failure; acute episodes of acidosis and dehydration may develop, and there may be photophobia associated with deposition of cystine in the eye.[1] Use of mercaptamine, which results in a reduction in the concentrations of cystine in leucocytes, has been shown to be effective in controlling many of the symptoms,[2-5] especially if begun early, although it has not been clear from contradictory results[4,6] how much benefit would be seen on renal function. Excellent clinical outcomes were reported[7] on long-term follow-up of 2 siblings with severe nephropathic cystinosis, reinforcing the need for early and diligent treatment in order to avoid progressive renal disease. Compliance may be a problem, because of the taste and odour of mercaptamine, and the more palatable prodrug phosphocysteamine has been developed as an alternative;[8,9] more palatable formulations of mercaptamine are also being investigated. Mercaptamine eye drops are reportedly of benefit in reversing or preventing deposition of corneal cystine crystals.[10] A strength of 0.11% has been used. Renal transplantation may be necessary if renal failure develops.

1. Gahl WA, *et al.* Cystinosis. *N Engl J Med* 2002; **347:** 111–21.
2. Yudkoff M, *et al.* Effects of cysteamine therapy in nephropathic cystinosis. *N Engl J Med* 1981; **304:** 141–5.
3. Gahl WA, *et al.* Cysteamine therapy for children with nephropathic cystinosis. *N Engl J Med* 1987; **316:** 971–7.
4. Reznik VM, *et al.* Treatment of cystinosis with cysteamine from early infancy. *J Pediatr* 1991; **119:** 491–3.
5. Gahl WA, *et al.* Nephropathic cystinosis in adults: natural history and effects of oral cysteamine therapy. *Ann Intern Med* 2007; **147:** 242–50.
6. Markello TC, *et al.* Improved renal function in children with cystinosis treated with cysteamine. *N Engl J Med* 1993; **328:** 1157–62.
7. Kleta R, *et al.* Long-term follow-up of well-treated nephropathic cystinosis patients. *J Pediatr* 2004; **145:** 555–60.
8. Gahl WA, *et al.* Cystinosis: progress in a prototypic disease. *Ann Intern Med* 1988; **109:** 557–69.
9. van't Hoff WG, *et al.* Effects of oral phosphocysteamine and rectal cysteamine in cystinosis. *Arch Dis Child* 1991; **66:** 1434–7.
10. Kaiser-Kupfer MI, *et al.* A randomized placebo-controlled trial of cysteamine eye drops in nephropathic cystinosis. *Arch Ophthalmol* 1990; **108;** 689–93.

Preparations

Proprietary Preparations (details are given in Part 3)
Austral.: Cystagon; ***Belg.:*** Cystagon; ***Cz.:*** Cystagon; ***Denm.:*** Cystagon; ***Fin.:*** Cystagon; ***Fr.:*** Cystagon; ***Ger.:*** Cystagon; ***Ital.:*** Cystagon; ***Neth.:*** Cystagon; ***Pol.:*** Cystagon; ***Port.:*** Cystagon; ***Spain:*** Cystagon; ***Swed.:*** Cystagon; ***UK:*** Cystagon.

Mercuric Chloride

Bicloruro de Mercurio; Chlorid rtut'natý; Cloreto Mercúrico; Corrosive Sublimate; Gyvsidabrio dichloridas; Higany(II)-klorid; Hydrarg. Perchlor.; Hydrargyri dichloridum; Hydrargyri Perchloridum; Hydrargyrum Bichloratum; Kvicksilverdiklorid; Mercuric Chlor.; Mercúrico, cloruro; Mercurique (Chlorure); Mercurique, chlorure; Mercury Bichloride; Mercury Perchloride; Merkuridikloridi; Quecksilberchlorid; Rtęci(II) chlorek.

$HgCl_2$ = 271.5.
CAS — 7487-94-7.
ATC — D08AK03.
ATC Vet — QD08AK03.

Pharmacopoeias. In *Eur.* (see p.vii).
Ph. Eur. 6.2 (Mercuric Chloride). A white or almost white, crystalline powder, or colourless or white or almost white crystals or heavy crystalline masses. Soluble in water and in glycerol; freely soluble in alcohol. Protect from light.

Profile

The use of mercuric chloride as an antibacterial substance is limited by its toxicity, its precipitating action on proteins, its irritant action on raw surfaces, its corrosive action on metals, and by the fact that its activity is greatly reduced in the presence of excreta or body fluids.

Details of the adverse effects of inorganic mercury compounds are provided under Mercury, below.

Preparations

Proprietary Preparations (details are given in Part 3)
Multi-ingredient: ***Spain:*** Pantenil.

Yellow Mercuric Oxide

Gelbes Quecksilberoxyd; Hydrargyri Oxidum Flavum; Hydrargyri Oxydum Flavum; Mercúrico amarillo, óxido; Mercurique (Oxyde) Jaune; Oxido Amarillo de Mercurio; Yellow Precipitate.

HgO = 216.6.
CAS — 21908-53-2.

Pharmacopoeias. In *Fr.* and *It.*

Profile

Yellow mercuric oxide has been used in eye ointments for the local treatment of minor infections including the eradication of pubic lice from the eyelashes. Absorption can occur and produce the adverse effects of inorganic mercury (see Mercury, below).

Pediculosis. Yellow mercuric oxide 1% eye ointment was considered to be a safe and effective treatment in pediculosis (p.2034) of the eyelashes caused by pubic lice (pthiriasis palpebrarum).[1]

1. Ashkenazi I, *et al.* Yellow mercuric oxide: a treatment of choice for phthiriasis palpebrarum. *Br J Ophthalmol* 1991; **75:** 356–8.

Porphyria. Mercuric oxide has been associated with acute attacks of porphyria and is considered unsafe in porphyric patients.

Preparations

Proprietary Preparations (details are given in Part 3)
Austral.: Golden Eye Ointment†; ***Fr.:*** Pommade Maurice.
Multi-ingredient: ***Hung.:*** Dermaforine†; ***India:*** Bell Diono Resolvent; Bell Resolvent.

Mercurous Chloride

Calomel; Calomelanos; Cloreto Mercuroso; Hydrarg. Subchlor.; Hydrargyri Subchloridum; Hydrargyrosi Chloridum; Hydrargyrum Chloratum (Mite); Mercureux (Chlorure); Mercurioso, cloruro; Mercurius Dulcis; Mercury Monochloride; Mercury Subchloride; Mild Mercurous Chloride; Protocloruro de Mercurio; Quecksilberchlorür.

HgCl = 236.0; Hg_2Cl_2 = 472.1.
CAS — 7546-30-7 (HgCl); 10112-91-1 (Hg_2Cl_2).

NOTE. Precipitated Mercurous Chloride (Hydrargyri Subchloridum Praecipitatum), is a white amorphous powder, for which the synonym 'White Precipitate' (Praecipitatum Album) has been used. White Precipitate has also been used as a name for Ammoniated Mercury.

Pharmacopoeias. In *Chin.* as Hg_2Cl_2.

Profile

Mercurous chloride was formerly given as a laxative and was applied topically as an antibacterial. It was one of the mercury compounds employed in the management of syphilis in the pre-antibiotic era.

The mercurous form of mercury does not possess the corrosive properties of the mercuric form and is not absorbed to any great extent. However, the mercurous form can be converted to the mercuric, with consequent toxicity as described under Mercury (see below).

Preparations

Proprietary Preparations (details are given in Part 3)
Multi-ingredient: ***Hung.:*** Dermaforine†.

Mercury

Hydrarg.; Hydrargyrum; Hydrargyrum Depuratum; Mercure; Mercurio; Quecksilber; Quicksilver; Rtęć.

Hg = 200.59.
CAS — 7439-97-6.
ATC — D08AK05.

Description. Mercury is a shining, silvery white, very mobile liquid, easily divisible into globules, which readily volatilises on heating.

Adverse Effects

Poisoning with liquid mercury or inorganic mercury salts has arisen from sources such as batteries, cosmetics, dental materials, medical equipment, and jewellery manufacture. Barometers, sphygmomanometers, and thermometers are still sources of liquid mercury. Trace amounts of organic and inorganic mercury may also be ingested in the diet.

The effects of **acute** exposure depend on the nature of the compound.

- *Elemental (liquid) mercury* if ingested is poorly absorbed and, unless there is aspiration or pre-existing gastrointestinal disorders, is not considered to be a severe toxicological hazard. The greatest dangers from elemental mercury arise from the inhalation of mercury vapour, which can cause gastrointestinal effects including nausea, vomiting, and diarrhoea; more importantly it is toxic to the respiratory system and this effect can be fatal. Some CNS involvement has also been reported. Adverse effects have also been reported after accidental or intentional parenteral dosage.
- *Inorganic salts* such as mercuric chloride are corrosive when ingested causing severe nausea, vomiting, pain, bloody diarrhoea, and necrosis. The kidney is also involved and tubular necrosis may develop. Mercurous salts are considered to be less hazardous, but the mercurous form can be converted to the mercuric.
- *Organic mercurial compounds* produce similar toxic effects to inorganic compounds, but they have a more selective action on the CNS that has proved difficult to treat. The degree of toxicity varies; those used as preservatives or disinfectants are less toxic than the ethyl or methyl compounds that are not used pharmaceutically or clinically. Methylmercury is notorious for its toxicity; there have been cases of fetal neurotoxicity during outbreaks of methylmercury poisoning.

Chronic mercury poisoning may result from inhalation of mercury vapour, skin contact with mercury or mercury compounds, or ingestion of mercury salts over prolonged periods. It is characterised by many symptoms including tremor, motor and sensory disturbances, mental deterioration, gastrointestinal symptoms, dermatitis, kidney damage, salivation, and gingivitis. A blue line may be present on the gums. There is little difference between acute and chronic poisoning with organic mercurials.

The syndrome of *acrodynia* (pink disease), with symptoms of sweat, rash, erythema of the extremities, photophobia, wasting, weakness, hypertension, tachycardia, and diminished reflexes, occurred in children given mercury in teething powders or in ointments or dusting powders. Such preparations have long since been withdrawn from use. However, the syndrome is still a feature of mercury poisoning from other sources.

Hypersensitivity to mercury and mercurial compounds has been reported.

Mercurialentis has been reported in patients treated with eye drops containing an organomercurial preservative.

Chronic exposure. Acute *occupational exposure* to mercury vapour in 53 men resulted in an initial phase described as metal fume fever, an intermediate phase of severe symptoms with CNS, gastrointestinal, respiratory, and urological involvement, and a late phase with persistent CNS symptoms, dysuria, and pain on ejaculation.[1,2] Although persistent hyperchloraemia was noted in the 11 patients with the highest mercury levels, renal impairment tended to be temporary.[2]

Long-term follow-up of a patient who had an intravenous *injection* of mercury 12 years previously also revealed no persistent renal impairment,[3] despite the presence of mercury microemboli in lungs, kidneys, liver, and subcutaneous tissues and high concentrations in the urine. At this time, the patient had residual reductions in respiratory function, polyneuropathy, and marked asthenozoospermia. Spermatozoal abnormalities may also have contributed to his wife's miscarriage. Mercury deposits mimicking gallbladder cancer were found in the gallbladder of a patient 35 years after he had injected himself with elemental mercury.[4]

Fetal neurotoxicity after *maternal exposure* to methylmercury is well recognised, and there has been widespread concern about the effect of maternal diets on the developing fetus because of mercury concentrations in freshwater and marine organisms. Results from a study in the Faroe Islands showed an association between delays in neurological development in children and maternal consumption of pilot whale meat.[5] Follow-up studies of this population when they reached 14 years of age suggest that the neurotoxic effects of methylmercury might compromise brain development into the teenage years,[6] as well as affecting autonomic regulation of heart function.[7] However, data from a study conducted in a fish-consuming population in the Seychelles failed to find a similar connection.[8]