reverse the effects of competitive muscle relaxants (see Neostigmine, p.632). The dose is glycopyrronium bromide 200 micrograms intravenously per 1 mg of neostigmine (or per 5 mg of pyridostigmine); alternatively, it may be given in a dose of 10 to 15 micrograms/kg intravenously with neostigmine 50 micrograms/kg. A suggested dosage for neonates and children is 10 micrograms/kg intravenously with neostigmine 50 micrograms/kg. Glycopyrronium bromide can be given mixed in the same syringe with the anticholinesterase, and it has been suggested that greater cardiovascular stability results from use in this way.

Gastrointestinal disorders. Antimuscarinics, including glycopyrronium bromide, have a limited role as antispasmodics (see p.1692), and have been used as adjuncts in the treatment of peptic ulcer disease (see p.1702).

As an adjunct in the treatment of peptic ulcer disease the usual initial dose of glycopyrronium bromide has been 3 to 6 mg daily by mouth in divided doses adjusted according to response to a maximum of 8 mg daily; a maintenance dose of 1 mg twice daily is often adequate. Doses of 100 to 200 micrograms have been given by intramuscular or intravenous injection.

Hyperhidrosis. Adverse effects generally preclude oral use of antimuscarinics for the management of hyperhidrosis (p.1580), but glycopyrronium, has been applied topically as an alternative to aluminium salts.

In studies involving 22 patients with the Frey syndrome (localised flushing and sweating on eating) glycopyrronium bromide as 1 and 2% cream or roll-on solution gave good control of symptoms;[1] patients tended to prefer the roll-on lotion as it was easier to apply. Topical hyoscine as 0.25, 1, or 3% solution or cream also gave control of sweating, but was associated with a much higher incidence of adverse effects. Patients with diabetic gustatory sweating have also noted a reduction in the frequency and severity of episodes after applying glycopyrronium 0.5% cream.[2]

Glycopyrronium bromide has also been used as a 0.05% solution in the iontophoretic treatment of hyperhidrosis.

1. Hays LL, *et al*. The Frey syndrome: a simple, effective treatment. *Otolaryngol Head Neck Surg* 1982; **90:** 419–25.
2. Shaw JE, *et al.* A randomised controlled trial of topical glycopyrrolate, the first specific treatment for diabetic gustatory sweating. *Diabetologia* 1997; **40:** 299–301.

Palliative care. Glycopyrronium bromide is used in palliative care as an alternative to hyoscine to reduce excessive respiratory secretions. A dose of 200 micrograms may be given subcutaneously or intramuscularly every 4 hours. Alternatively, a dose of 0.6 to 1.2 mg may be given by continuous subcutaneous infusion over 24 hours.

Respiratory-tract disorders. Antimuscarinics have potent bronchodilatory activity and some, such as ipratropium (p.1124), may be used in the management of reversible airways obstruction. Glycopyrronium has been studied, although it is not one of the preferred drugs.

References.

1. Schroeckenstein DC, *et al*. Twelve-hour bronchodilation in asthma with a single aerosol dose of the anticholinergic compound glycopyrrolate. *J Allergy Clin Immunol* 1988; **82:** 115–19.
2. Gilman MJ, *et al*. Comparison of aerosolized glycopyrrolate and metaproterenol in acute asthma. *Chest* 1990; **98:** 1095–8.
3. Cydulka RK, Emerman CL. Effects of combined treatment with glycopyrrolate and albuterol in acute exacerbation of chronic obstructive pulmonary disease. *Ann Emerg Med* 1995; **25:** 470–3.

Preparations

USP 31: Glycopyrrolate Injection; Glycopyrrolate Tablets.

Proprietary Preparations (details are given in Part 3)
Arg.: Acpan; ***Austral.:*** Robinul; ***Austria:*** Robinul; ***Belg.:*** Robinul; ***Denm.:*** Robinul; ***Fin.:*** Robinul; ***Ger.:*** Robinul; ***Hong Kong:*** Robinul†; ***Norw.:*** Robinul; ***NZ:*** Robinul; ***S.Afr.:*** Robinul; ***Swed.:*** Robinul; ***UK:*** Robinul; ***USA:*** Robinul.

Multi-ingredient: ***Fin.:*** Gastrodyn comp.

Used as an adjunct in: ***Belg.:*** Robinul-Neostigmine; ***Denm.:*** Robinul-Neostigmin; ***Fin.:*** Glycostigmin; Robinul-Neostigmin; ***Norw.:*** Robinul-Neostigmin; ***Swed.:*** Robinul-Neostigmin; ***Switz.:*** Robinul-Neostigmine; ***UK:*** Robinul-Neostigmine.

Glycyrrhizic Acid

Glycyrrhizin; Glycyrrhizinic Acid.

$C_{42}H_{62}O_{16}$ = 822.9.

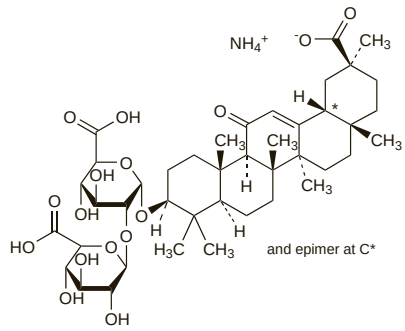
CAS — 1405-86-3.

Ammonium Glycyrrhizate

Ammonii glycyrrhizas; Ammonium, glycyrrhizate d'; Ammonium Glycyrrhizinate; Ammónium-glicirrizát; Ammoniumglycyrrhizat; Ammoniumglykyrritsaatti; Amonio glicirizatas; Amonium-glycyrrhizát; Glycyrram; Monoammonium Glycyrrhizinate.

$C_{42}H_{65}NO_{16}$ = 840.0.

CAS — 53956-04-0.



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

Ph. Eur. 6.2 (Ammonium Glycyrrhizate). A white or yellowish-white, hygroscopic powder. Slightly soluble in water; very slightly soluble in alcohol; practically insoluble in acetone. It dissolves in dilute solutions of acids and of alkali hydroxides. Store in airtight containers.

Dipotassium Glycyrrhizate

Potassium Glycyrrhizinate.

$C_{42}H_{60}K_2O_{16}$ = 899.1.

CAS — 68039-19-0 (potassium glycyrrhizate); 42294-03-1 (monopotassium glycyrrhizate); 68797-35-3 (dipotassium glycyrrhizate);.

Profile

Glycyrrhizic acid is a constituent of liquorice (p.1740). The mild anti-inflammatory and mineralocorticoid properties of liquorice have been attributed to the presence of glycyrrhizic acid and its metabolite glycyrrhetinic acid (Enoxolone, p.50).

Glycyrrhizic acid and its ammonium and potassium salts have been used in products promoted for the relief of coughs, viral infections, and gastrointestinal, liver, and skin disorders. Ammonium glycyrrhizate has also been used as a sweetener, flavour enhancer, and as an emulsifying and gel-forming agent in foodstuffs and cosmetics.

Other derivatives of glycyrrhizic acid discussed elsewhere include metoclopramide glycyrrhizinate (p.1749) and enoxolone (p.50).

Preparations

Proprietary Preparations (details are given in Part 3)
Arg.: Epigen; ***Indon.:*** Neo-Minophagen C; ***Jpn:*** Neo-Minophagen C; ***Mex.:*** Epigen; ***Rus.:*** Epigen (Эпиген).

Multi-ingredient: ***Austria:*** Enicul; ***Fr.:*** Keracnyl stop bouton; Topialyse Fluide; Topialyse Plus; ***Ital.:*** Biothymus DS; ***Jpn:*** Colgen Kowa Bien Soft Mini; ***Mex.:*** Bexident Pediatrics†; ***Port.:*** Alkagin; Bexident.

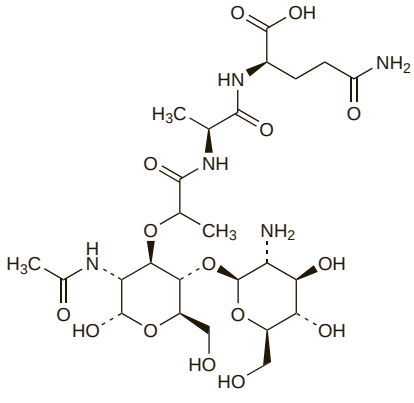
GMDP

Glucosaminylmuramyl Dipeptide. *N*-acetylglucosaminyl-β1-4-*N*-acetylmuramyl-alanyl-D-isoglutamine.

ГМДП

$C_{25}H_{43}N_5O_{15}$ = 653.6.

CAS — 97590-38-0.



Profile

GMDP, a component of bacterial cell walls, is reported to have immunomodulator properties and is used in a wide range of diseases stated to be associated with secondary immunodeficiency.

Preparations

Proprietary Preparations (details are given in Part 3)
Rus.: Licopid (Ликопид).

Gold

Aurum; E175; Or; Oro.

Au = 196.966569.

CAS — 7440-57-5.

Profile

Gold is a bright-yellow, malleable, and ductile metal; the finely divided powder may be black, ruby, or purple. The main use of metallic gold in health care is now in dentistry. Gold may also be used as a colouring agent for some foodstuffs. In the treatment of rheumatoid arthritis, gold is used in the form of compounds such as auranofin (p.25), aurothioglucose (p.26), and sodium aurothiomalate (p.122). The radionuclide gold-198 is described in the chapter on radiopharmaceuticals (p.2053). There have been rare reports of hypersensitivity reactions to metallic gold.

Homoeopathy. Gold has been used in homoeopathic medicines under the following names: Aurum; Aurum met.; Aurum metallicum; Aur. met.

◊ References.

1. Merchant B. Gold, the noble metal and the paradoxes of its toxicology. *Biologicals* 1998; **26:** 49–59.
2. Ehrlich A, Belsito DV. Allergic contact dermatitis to gold. *Cutis* 2000; **65:** 323–6.

Preparations

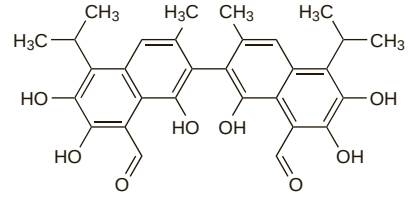
Proprietary Preparations (details are given in Part 3)
Multi-ingredient: ***Ger.:*** Cefassin†.

Gossypol

Gosipol. 2,2′-Bis(1,6,7-trihydroxy-3-methyl-5-isopropylnaphthalene-8-carboxaldehyde).

$C_{30}H_{30}O_8$ = 518.6.

CAS — 303-45-7.



Profile

Gossypol is a pigment extracted from cottonseed oil (p.2288). It possesses antispermatogenic activity and has been studied, especially in China, as a male contraceptive. It has also been investigated for its antineoplastic, antiprotozoal, antiviral, and spermicidal activity and has been studied in women in the treatment of gynaecological disorders.

Adverse effects have included fatigue, changes in appetite, gastrointestinal effects, burning sensation of the face and hands, some loss of libido, and persistent oligospermia. Hypokalaemia has occurred.

◊ The pharmacology and therapeutic potential of gossypol have been reviewed.[1] Although controlled studies[2,3] have shown gossypol to be an effective male contraceptive, WHO concluded[4] that gossypol would not be acceptable as a male antifertility drug because of the occurrence of adverse effects such as hypokalaemia and irreversible testicular damage resulting in azoospermia or severe oligozoospermia.

1. Wu D. An overview of the clinical pharmacology and therapeutic potential of gossypol as a male contraceptive agent and in gynaecological disease. *Drugs* 1989; **38:** 333–41.
2. Coutinho EM, *et al*. Antispermatogenic action of gossypol in men. *Fertil Steril* 1984; **42:** 424–30.
3. Liu G, *et al*. Clinical trial of gossypol as a male contraceptive drug part I: efficacy study. *Fertil Steril* 1987; **48:** 459–61.
4. Waites GMH, *et al*. Gossypol: reasons for its failure to be accepted as a safe, reversible male antifertility drug. *Int J Androl* 1998; **21:** 8–12.

Grape

Grapevine; Rebe; Vigne Rouge; Weinstock.

NOTE. Distinguish from grape bark, Cocillana, p.1554.

Pharmacopoeias. *Fr.* includes Red Vine Extract (Extrait de Vigne Rouge (Sec)), prepared from the leaves.

Profile

The seeds and the leaves of the grape, *Vitis vinifera* (Vitaceae), are used in herbal medicine. The dried fruit (raisins) have laxative and demulcent properties.

Many parts of the plant including the fruit skin, seeds, and leaves are used. Both dietary sources and various extracts are promoted for their antoxidant properties in venous insufficiency and capillary impairment, and it has been suggested that they may protect against atherosclerosis.

A standardised red vine leaf extract (AS-195) has been given for the management of chronic venous insufficiency.