Much lower doses have been recommended for the treatment of gastrointestinal and biliary-tract spasm.

Preparations

Proprietary Preparations (details are given in Part 3)
Ger.: Certonal†; Kollateral.

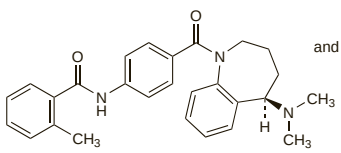
Multi-ingredient: ***Austria:*** Hedonin.

Mozavaptan *(rINN)* ⊗

Manavaptan; Mozavaptán; Mozavaptanum; OPC-31260. *N*-(4-{[(5*RS*)-5-(Dimethylamino)-2,3,4,5-tetrahydro-1*H*-1-benzazepin-1-yl]carbonyl}phenyl)-2-methylbenzamide.

Мозаваптан

$C_{27}H_{29}N_3O_2$ = 427.5.
CAS — 137975-06-5.



and enantiomer

Profile
Mozavaptan is a selective vasopressin V_2-receptor antagonist used for the treatment of hyponatraemia in cancer-related syndrome of inappropriate antidiuretic hormone secretion.

Mulungu

Profile
The bark of the mulungu tree, *Erythrina verna* (*E. mulungu*) Fabaceae, has traditionally been used in South America as a sedative and as a hypotensive.

Preparations

Proprietary Preparations (details are given in Part 3)

Multi-ingredient: ***Braz.:*** Anevrase†; Calmapax; Elixir de Passiflora†; Passaneuro; Passicalm†; Passiflora Composta†; Passilex†; Sedalin†; Xarope Sao Joao†.

Mumps Skin Test Antigen

Parotiditis, prueba cutánea contra el antígeno de la.

Pharmacopoeias. In *US*.
USP 31 (Mumps Skin Test Antigen). A sterile suspension of formaldehyde-inactivated mumps virus prepared from the extra-embryonic fluid of virus-infected chick embryos, concentrated and purified by differential centrifugation, and diluted with isotonic sodium chloride solution. It contains a preservative and glycine as a stabilising agent. Each mL contains not less than 20 complement-fixing units. It should be stored at 2° to 8°. The expiry date is not later than 18 months after date of manufacture or of release from manufacturer's cold storage.

Profile
Recovery from mumps produces skin hypersensitivity to mumps virus. Mumps skin test antigen, has been used with other antigens to assess the status of cell-mediated immunity. A positive reaction may indicate previous infection with mumps virus but it is not considered to be very reliable. It should not be given to patients hypersensitive to egg protein.

Preparations

USP 31: Mumps Skin Test Antigen.

Proprietary Preparations (details are given in Part 3)
USA: MSTA†.

Muramidase Hydrochloride

N-Acetylmuramide Glycanohydrolase Hydrochloride; E1105 (muramidase); Globulin G_1 Hydrochloride; Lysozyme Hydrochloride; Muramidasa, hidrocloruro de.

CAS — 9001-63-2 (muramidase); 9066-59-5 (muramidase hydrochloride).
ATC — D06BB07; J05AX02.
ATC Vet — QD06BB07; QJ05AX02.

Pharmacopoeias. In *Jpn*.

Profile
Muramidase is a mucopolysaccharidase normally present in saliva and other tissues and secretions. It is active against Gram-positive bacteria, possibly by transforming the insoluble polysaccharides of the cell wall to soluble mucopeptides. It is also thought to be active against some viruses and some Gram-negative bacteria.

Muramidase has been given, usually as the hydrochloride, to patients with herpes zoster and other painful viral infections, and for mouth and respiratory-tract disorders. It has been used with antibacterials in an attempt to enhance their activity. Sensitivity reactions have been reported.

Adverse effects. A report[1] of a toxic epidermal necrolysis-type drug eruption in a patient who took an oral cold preparation containing muramidase chloride, which was considered to be the probable cause. The patient's condition improved after intravenous corticosteroid therapy.

1. Kobayashi M, *et al*. A case of toxic epidermal necrolysis-type drug eruption induced by oral lysozyme chloride. *J Dermatol* 2000; **27:** 401–4.

Preparations

Proprietary Preparations (details are given in Part 3)
Belg.: Murazyme; ***Braz.:*** Murazyme†; ***Hong Kong:*** CP-Lyso; Eurozyme; Flemizyme; Jemizym†; Leftose; Lysosmin; Neuzym; ***Ital.:*** Immunozima†; ***Jpn:*** Leftose; Neuzym; ***Malaysia:*** Leftose†; Neuzym; Noflux; ***Singapore:*** Leftose; Lyzyme; Neuflo; Neuzyme; ***Thai.:*** Leftose.

Multi-ingredient: ***Arg.:*** Bim†; Gammanova†; ***Braz.:*** Colpistar; Tricomax; Trinotrex†; ***Cz.:*** Laryprontt†; ***Fr.:*** Cantalene; Glossithiase; Hexalyse; Lyso-6; Lysopaine; ***Ger.:*** Frubienzym; ***Gr.:*** Lyso-6; Lysopaine; Sopain-Plus; ***Hong Kong:*** Hexalyse; Quadezyme; ***Ital.:*** Narlisim; ***Port.:*** Narizima; ***Rus.:*** Hexalyse (Гексализ); Lysobact (Лизобакт); ***Singapore:*** Biotene; ***Spain:*** Egarone†; Espectral†; Lizipaina; Normo Nar†; Pulmotropic; Rino Dexa; Trofalgon; ***Switz.:*** Arbid-top; Gem; Lyso-6†; Lysopaine; Mebucasol f; Sangerol; ***Thai.:*** Siduol; ***UK:*** Biotene Dry Mouth; BioXtra†; ***USA:*** Biotene with Calcium.

Poisonous Mushrooms or Toadstools

Champignons vénéneux; Giftpilze; Setas venenosas.

CAS — 23109-05-9 (α-amanitin); 21150-22-1 (β-amanitin); 21150-23-2 (γ-amanitin); 58919-61-2 (coprine); 16568-02-8 (gyromitrin); 2552-55-8 (ibotenic acid); 60-34-4 (methylhydrazine); 300-54-9 (muscarine); 2763-96-4 (muscimol); 37338-80-0 (orellanine); 17466-45-4 (phalloidin); 28227-92-1 (phalloin); 39412-56-1 (phallolysin).

Classification
This monograph describes poisonous mushrooms often known as toadstools, their toxins, toxic effects, and the treatment of those effects. Their only use is in homoeopathic medicine (see below). *Amanita muscaria* and *Psilocybe* spp. are abused for their psychoactive properties (see also Psilocin, p.2375).

Mushrooms can be classified into 8 groups according to their principal toxins and toxic effects:

- *Group I.* Most deaths due to mushroom poisoning follow the ingestion of mushrooms containing cyclopeptides and among these mushrooms *Amanita phalloides* ('death cap') has been reported to be responsible for 90% of all mushroom fatalities. The cyclopeptides are a group of heat-stable cyclic polypeptides with molecular weights ranging from 800 to 1100 and include the amatoxins (α-, β-, γ-amanitin) and phallotoxins (phalloidin, phaloin, phallolysin). Other mushrooms containing cyclopeptides include *A. verna* ('deadly agaric', 'fool's mushroom'), *A. virosa*, ('destroying angel') and *A. bisporigera* ('white destroying angel'), and *Galerina autumnalis*, *G. marginata*, and *G. venenata*.
- *Group II.* Although *A. muscaria* ('fly agaric') and *A. pantherina* ('panther cap', 'false blusher') may contain small amounts of muscarine, the antimuscarinic effects of the hallucinogenic agent muscimol and the insecticidal agent ibotenic acid usually predominate.
- *Group III.* Many species of *Gyromitra* contain toxins known as gyromitrins that decompose to release methylhydrazine (monomethylhydrazine; MMH) an inhibitor of the coenzyme pyridoxal phosphate.
- *Group IV.* Mushrooms whose principal toxin is muscarine include many of the *Clitocybe* and *Inocybe* spp. *A. muscaria* and *A. pantherina* (see above) may also contain small amounts.
- *Group V. Coprinus atramentarius* ('ink cap') contains the compound coprine, one of whose metabolites is an inhibitor of acetaldehyde dehydrogenase and it may therefore produce 'disulfiram-like' symptoms after drinking alcohol.
- *Group VI.* Mushrooms that may contain the hallucinogenic indoles psilocin and psilocybine include species of *Psilocybe*, *Panaeolus*, *Gymnopilus*, *Stropharia*, and *Conocybe*.
- *Group VII.* Many mushrooms that only act as gastrointestinal irritants and do not produce systemic effects are included in this group.
- *Group VIII.* A further group has sometimes been used to classify some species of *Cortinarius* that contain a renal toxin thought by some to be orellanine, but whose exact nature remains to be determined.

Adverse Effects
The clinical course of poisoning due to mushrooms is related to their principal toxins:

- *Group I.* Initial symptoms may occur 6 to 24 hours after ingestion of mushrooms containing cyclopeptides, and usually consist of gastrointestinal effects such as abdominal pain, nausea, severe vomiting, and profuse diarrhoea similar to that in cholera. The patient may then appear to recover and be symptom-free for 2 to 3 days, although liver-enzyme values may be increasing. After this phase, the more serious toxic effects of the amatoxins become apparent and there are signs of hepatic, renal, cardiac, and CNS toxicity. Symptoms include jaundice, oliguria, anuria, hypoglycaemia, coagulopathies, circulatory collapse, convulsions, and coma. The mortality rate is high in this third phase, with death usually being due to hepatic failure following hepatic necrosis. Up to 90% of untreated patients may die, though the rate can be as low as 15 to 30% after treatment.
- *Group II.* The adverse effects of mushrooms containing ibotenic acid and muscimol usually occur within 2 hours of ingestion. Symptoms may include ataxia, euphoria, delirium, and hallucinations associated with other antimuscarinic effects. Fatalities are rare.
- *Group III.* Patients who have ingested mushrooms containing gyromitrins usually develop symptoms of poisoning within 6 to 24 hours. These consist initially of nausea, vomiting, abdominal pain, and muscle cramps, headache, dizziness and fatigue. Delirium, convulsions, coma, methaemoglobinaemia and haemolysis may also occur. Occasionally jaundice and hepatic necrosis lead to hepatic failure and death. Up to 40% of patients die.
- *Group IV.* Symptoms typical of 'cholinergic crisis' (see Adverse Effects of Neostigmine, p.631) may appear about 30 minutes to 2 hours after ingestion of mushrooms containing muscarine. These include bradycardia, bronchospasm, salivation, perspiration, lachrymation, rhinorrhoea, involuntary urination and defaecation, and diarrhoea. Miosis, hypotension, and cardiac arrhythmias may also occur. Rarely death may follow due to cardiac arrest or respiratory-tract obstruction.
- *Group V.* Since one of the metabolites of coprine is an acetaldehyde dehydrogenase inhibitor, drinking alcohol, even up to several days after ingestion of mushrooms containing this compound, will produce symptoms similar to those of the 'disulfiram-alcohol' interaction (see Disulfiram, Adverse Effects, p.2296). Fatalities are rare.
- *Group VI.* The adverse effects of ingestion of mushrooms containing psilocin and psilocybine are similar to those described under lysergide (p.2335). Symptoms usually occur within about 30 minutes to 2 hours. Fatalities are rare.
- *Group VII.* Generally no treatment is required for adverse gastrointestinal effects seen with this group of mushrooms.
- *Group VIII.* There may be a delay of as long as 14 to 20 days before symptoms of poisoning due to *Cortinarius* appear. Patients will develop an intense thirst. Other symptoms usually include nausea, vomiting, diarrhoea, and anorexia. Muscle aching and spasms and a feeling of coldness may also occur. In severe cases renal failure may lead to death. It has been reported that up to 15% of patients die.

Pregnancy. α-Amanitine does not appear to cross the placental barrier, even during the acute phase of intoxication.[1]

1. Belliardo F, *et al*. Amatoxins do not cross the placental barrier. *Lancet* 1983; **i:** 1381.

Treatment of Adverse Effects
As there are no specific antidotes for the majority of cases of mushroom poisoning and which species is involved is often unknown, treatment consists primarily of symptomatic and supportive measures. The stomach may be emptied by gastric lavage if the patient has not already vomited spontaneously. However, if presentation is delayed (because of the slow onset of symptoms seen with some types of mushrooms) measures to empty the stomach are unlikely to be productive. Activated charcoal may be of use in binding toxins in the gastrointestinal tract and preventing absorption. Determining the interval between ingestion and the onset of symptoms often helps to identify the type of mushrooms ingested. If possible specimens of the mushrooms or a sample of the stomach contents should be sent to an expert mycologist for identification. Particular attention should be paid to intravenous replacement of fluids and electrolytes especially if vomiting and diarrhoea are severe. If the ingestion of hepatotoxic or nephrotoxic mushrooms is suspected liver and renal function should be monitored.

Since some mushrooms contain a wide range of toxins and patients may have ingested more than one species, specific therapy should only be instituted following positive identification.

- *Group I.* There is little clinical evidence to support the efficacy of specific agents or treatments for the management of cyclopeptide poisoning. Drugs such as benzylpenicillin, silymarin or silibinin have been given to try to protect the liver against the hepatotoxic effects of the amatoxins. Exchange transfusions, haemodialysis, or charcoal haemoperfusion have been tried to facilitate amatoxin removal. The removal of bile via a duodenal tube left *in situ* has been suggested to reduce enterohepatic circulation of amatoxins. Forced diuresis has also been advocated. Liver transplantation may be required for progressive hepatic failure. A radio-immunoassay for the detection of amatoxins is available in some countries to confirm a diagnosis of cyclopeptide poisoning.