30. Khaw K-T, *et al.* Relation between plasma ascorbic acid and mortality in men and women in EPIC-Norfolk prospective study: a prospective population study. *Lancet* 2001; **357:** 657–63.
31. Ingraham BA, *et al.* Molecular basis of the potential of vitamin D to prevent cancer. *Curr Med Res Opin* 2008; **24:** 139–49.
32. Bairati I, *et al.* A randomized trial of antioxidant vitamins to prevent second primary cancers in head and neck cancer patients. *J Natl Cancer Inst* 2005; **97:** 481–8.
33. Heinonen OP, *et al.* Prostate cancer and supplementation with α-tocopherol and β-carotene: incidence and mortality in a controlled trial. *J Natl Cancer Inst* 1998; **90:** 440–6.
34. Giovannucci E, *et al.* Multivitamin use, folate, and colon cancer in women in the Nurses' Health Study. *Ann Intern Med* 1998; **129:** 517–24.
35. Willett WC. Diet and cancer: one view at the start of the millennium. *Cancer Epidemiol Biomarkers Prev* 2001; **10:** 3–8.
36. Zhang S, *et al.* A prospective study of folate intake and the risk of breast cancer. *JAMA* 1999; **281:** 1632–7.
37. US Preventive Services Task Force. Routine vitamin supplementation to prevent cancer and cardiovascular disease: recommendations and rationale. *Ann Intern Med* 2003; **139:** 51–5.

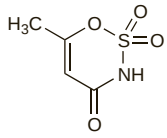
Acesulfame Potassium *(BANM, rINNM)*

Acesulfam draselná sůl; Acesulfam potasowy; Acesulfame K; Acésulfame potassique; Acesulfamkalium; Acesulfamo kalio druska; Acesulfamo potásico; Acesulfamum kalicum; Aceszulfámkálium; Asesulfaamikalium; E950; H73-3293; H-733293; Hoe-095K; Kalii Acesulfamum. 6-Methyl-1,2,3-oxathiazin-4(3*H*)-one 2,2-dioxide potassium.

Калия Ацесульфам

$C_4H_4KNO_4S$ = 201.2.

CAS — 55589-62-3.



(acesulfame)

Pharmacopoeias. In *Eur.* (see p.vii). Also in *USNF.*

Ph. Eur. 6.2 (Acesulfame Potassium). A white or almost white, crystalline powder or colourless crystals. Soluble in water; very slightly soluble in alcohol and in acetone.

USNF 26 (Acesulfame Potassium). A white, crystalline powder or colourless crystals. Soluble in water; very slightly soluble in alcohol and in acetone. Protect from light.

Profile

Acesulfame potassium is an intense sweetener about 200 times as sweet as sucrose. It is used in beverages, cosmetics, pharmaceuticals, and foods and does not appear to be affected by cooking.

Preparations

Proprietary Preparations (details are given in Part 3)

Multi-ingredient: ***Arg.:*** Equalsweet; Genser Sweet; Rondo Sweet; ***Chile:*** Marco Sweet Light; ***UK:*** Sweet 'n Low; ***Venez.:*** Hermesetas Gold; Sweet 'n' Low†.

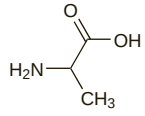
Alanine *(USAN, rINN)*

A; Ala; Alaniini; Alanin; Alanina; Alaninas; L-Alanine; Alaninum; NSC-206315. L-2-Aminopropionic acid.

Аланин

$C_3H_7NO_2$ = 89.09.

CAS — 56-41-7.



Pharmacopoeias. In *Chin.*, *Eur.* (see p.vii), and *US.*

Ph. Eur. 6.2 (Alanine). A white or almost white crystalline powder or colourless crystals. Freely soluble in water; very slightly soluble in alcohol. Protect from light.

USP 31 (Alanine). White, odourless, crystals or crystalline powder. Freely soluble in water; slightly soluble in 80% alcohol; insoluble in ether. pH of a 5% solution in water is between 5.5 and 7.0. Store in airtight containers.

Profile

Alanine is an aliphatic non-essential amino acid. It is used as a dietary supplement. The dipeptide *N*(2)-L-alanyl-L-glutamine is used similarly.

Hypoglycaemia. References to the investigational use of alanine in the management of insulin-induced hypoglycaemia.[1-4]

1. Wiethop BV, Cryer PE. Glycemic actions of alanine and terbutaline in IDDM. *Diabetes Care* 1993; **16:** 1124–30.
2. Wiethop BV, Cryer PE. Alanine and terbutaline in treatment of hypoglycemia in IDDM. *Diabetes Care* 1993; **16:** 1131–6.
3. Saleh TY, Cryer PE. Alanine and terbutaline in the prevention of nocturnal hypoglycemia in IDDM. *Diabetes Care* 1997; **20:** 1231–6.
4. Evans ML, *et al.* Alanine infusion during hypoglycaemia partly supports cognitive performance in healthy human subjects. *Diabet Med* 2004; **21:** 440–6.

Preparations

Proprietary Preparations (details are given in Part 3)

Fr.: Abufene; ***Singapore:*** Abufene.

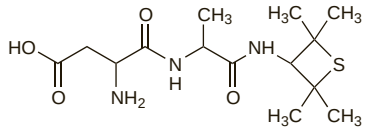
Multi-ingredient: ***Arg.:*** Normoprost Compuesto; ***Ital.:*** Chetonex; ***Spain:*** Tebetane Compuesto.

Alitame *(USAN)*

CP-54802. (3*S*)-Amino-*N*-{(1*R*)-1-[(2,2,4,4-tetramethyl-3-thietanyl) carbamoyl] ethyl} succinamic acid hydrate.

$C_{14}H_{25}N_3O_4S.2/H_2O$ = 376.5.

CAS — 80863-62-3 (anhydrous alitame); 99016-42-9 (alitame hydrate).



(anhydrous alitame)

Profile

Alitame is an intense sweetener used in foods. It is about 2000 times sweeter than sucrose.

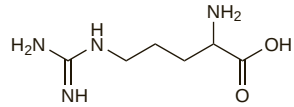
Arginine *(rINN)*

Arg; Arginiini; Arginin; Arginina; Argininas; L-Arginine; Argininum; R. L-2-Amino-5-guanidinovaleric acid.

Аргинин

$C_6H_{14}N_4O_2$ = 174.2.

CAS — 74-79-3.



Pharmacopoeias. In *Chin.*, *Eur.* (see p.vii), *Jpn*, and *US.*

Ph. Eur. 6.2 (Arginine). A white or almost white crystalline powder, or colourless crystals. Freely soluble in water; very slightly soluble in alcohol. Protect from light.

USP 31 (Arginine). White, practically odourless crystals. Freely soluble in water; sparingly soluble in alcohol; insoluble in ether.

Arginine Aspartate

Arginiiniaspartaatti; Arginina, aspartato de; Argininaspartat; Arginin-aspartát; Arginine, aspartate d'; Arginini aspartas; Arginino aspartatas; Asparginínum. (2*S*)-2-Amino-5-guanidinopentanoic acid (2*S*)-2-aminobutanedioate.

$C_{10}H_{21}N_5O_6$ = 307.3.

CAS — 7675-83-4.

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

Ph. Eur. 6.2 (Arginine Aspartate). White or almost white granules or powder. Very soluble in water, practically insoluble in alcohol and in dichloromethane.

Arginine Glutamate *(BAN, USAN, rINNM)*

Arginine, Glutamate d'; Arginini Glutamas; Glutamato de arginina. L-Arginine L-glutamate.

Аргинина Глутамат

$C_6H_{14}N_4O_2.C_5H_9NO_4$ = 321.3.

CAS — 4320-30-3.

ATC — A05BA01.

ATC Vet — QA05BA01.

Arginine Hydrochloride *(USAN, rINNM)*

Argininihydrokloridi; Arginine, chlorhydrate d'; L-Arginine Monohydrochloride; Arginin-hidroklorid; Arginin-hydrochlorid; Arginhydroklorid; Arginini hydrochloridum; Arginino hidrochloridas; Hidrocloruro de arginina.

Аргинина Гидрохлорид

$C_6H_{14}N_4O_2.HCl$ = 210.7.

CAS — 1119-34-2.

ATC — B05XB01.

ATC Vet — QB05XB01.

Pharmacopoeias. In *Chin.*, *Eur.* (see p.vii), *Jpn*, and *US.*

Ph. Eur. 6.2 (Arginine Hydrochloride). A white or almost white crystalline powder, or colourless crystals. Freely soluble in water; very slightly soluble in alcohol. Protect from light.

USP 31 (Arginine Hydrochloride). White, practically odourless, crystals or crystalline powder. Freely soluble in water.

Adverse Effects and Precautions

Nausea, vomiting, flushing, headache, numbness, and local venous irritation may occur if arginine solutions are infused too rapidly. Elevated plasma-potassium concentrations have been reported in uraemic patients and arginine should therefore be used with caution in patients with renal disease or anuria. Arginine hydrochloride should be given cautiously to patients with electrolyte disturbances as its high chloride content could lead to the development of hyperchloraemic acidosis.

Extravasation. Full-thickness skin necrosis has been reported[1,2] after extravasation of a 10% solution of arginine hydrochloride. Both osmotic and local hyperkalaemic effects have been proposed as a mechanism for the injury.[1]

1. Bowlby HA, Elanjian SI. Necrosis caused by extravasation of arginine hydrochloride. *Ann Pharmacother* 1992; **26:** 263–4.
2. Salameh Y, Shoufani A. Full-thickness skin necrosis after arginine extravasation—a case report and review of literature. *J Pediatr Surg* 2004; **39:** E9–E11.

Hyperkalaemia. Two alcoholic patients with severe liver disease and moderate renal insufficiency developed severe hyperkalaemia when given arginine hydrochloride and one died.[1] Both patients had received a total of 300 mg of spironolactone some time before arginine hydrochloride, but the contribution of spironolactone to the hyperkalaemia was not known. In a study to investigate the mechanism of metabolic changes due to arginine, plasma-potassium concentrations were found to be significantly higher in diabetic subjects than those for normal subjects, leading the authors to suppose that while arginine-induced hyperkalaemia may be promoted by low insulin blood levels, it could not be attributed to glucagon, pH changes, or aldosterone inhibition.[2]

In another fatal case due to an overdose of arginine,[3] a 21-month-old girl developed an acute metabolic acidosis with transient but severe hyponatraemia, and irreversible brain death; no hyperkalaemia was observed. Unlike the previously reported case, the patient had normal renal function, and the authors supposed the absence of hyperkalaemia to be due to a rapid increase in renal potassium excretion.

1. Bushinsky DA, Gennari FJ. Life-threatening hyperkalemia induced by arginine. *Ann Intern Med* 1978; **89:** 632–4.
2. Massara F, *et al.* The risk of pronounced hyperkalaemia after arginine infusion in the diabetic subject. *Diabete Metab* 1981; **7:** 149–53.
3. Gerard JM, Luisiri A. A fatal overdose of arginine hydrochloride. *J Toxicol Clin Toxicol* 1997; **35:** 621–5.

Hypersensitivity. There are 2 reports of anaphylactic reactions shortly after the start of infusions of arginine 5 or 10% given to test growth-hormone output.[1,2] Anaphylaxis to arginine was considered to be a very rare event and only one other apparent allergic reaction had been reported to the manufacturers.

1. Tiwary CM, *et al.* Anaphylactic reaction to arginine infusion. *N Engl J Med* 1973; **288:** 218.
2. Resnick DJ, *et al.* Case report of an anaphylactoid reaction to arginine. *Ann Allergy Asthma Immunol* 2002; **88:** 67–8.

Myocardial infarction. A placebo-controlled trial investigated whether the addition of arginine to standard therapy after myocardial infarction would decrease vascular stiffness and improve left ventricular function. The study was stopped early due to an increased number of deaths in the arginine group. The authors commented that, while the results could be due to chance, nevertheless arginine should not be given to patients after a myocardial infarction.[1]

1. Schulman SP, *et al.* -Arginine therapy in acute myocardial infarction: the Vascular Interaction with Age in Myocardial Infarction (VINTAGE MI) randomized clinical trial. *JAMA* 2006; **295:** 58–64.

Uses and Administration

Arginine is a basic amino acid that is essential for infant growth. It is used as a dietary supplement.

Arginine stimulates the release of growth hormone by the pituitary gland and may be used instead of, or in addition to, other tests such as insulin-induced hypoglycaemia, for the evaluation of growth disorders; false-positive and false-negative results are relatively common and evaluation therefore should not be made on the basis of a single arginine test. It is used as a 10% solution of the hydrochloride in usual doses of 30 g by intravenous infusion given over 30 minutes; children should be given 500 mg/kg.

Arginine is used in certain conditions accompanied by hyperammonaemia; for further details see below.

Arginine hydrochloride has also been used as an acidifying agent. In severe metabolic alkalosis intravenous doses have been calculated by the formula:

intravenous dose (in grams) =
desired decrease in plasma-bicarbonate concentration (mEq or mmol/litre)
×
[patient's body-weight (in kg)/9.6]

In forced acid diuresis to hasten drug elimination after overdose a suggested dose has been 10 g intravenously over 30 minutes. However, this has the potential to cause myoglobinuria with acute renal failure, and is rarely used.

Arginine may also be used in the form of the acetylasparaginate, aspartate, citrate, glutamate, oxoglurate, tidiacicate (thiazolidine-2,4-dicarboxylate), and timonacicate (thiazolidine-4-carboxylate). Formulation as an arginine salt is used to improve the solubility of a number of drugs, notably analgesics and antibacterials.

◊ References.

1. Tapiero H, *et al.* Arginine. *Biomed Pharmacother* 2002; **56:** 439–45.
2. Tong BC, Barbul A. Cellular and physiological effects of arginine. *Mini Rev Med Chem* 2004; **4:** 823–32.

Hyperammonaemia. Hyperammonaemia is a characteristic feature of inborn errors of the urea cycle, caused by defects in the enzymes carbamyl phosphate synthetase (CPS), ornithine transcarbamylase (OTC), argininosuccinate synthetase (ASS), argininosuccinate lyase (ASL), arginase (causing hyperargininaemia), or *N*-acetylglutamate synthase (NAGS).[1,2] During the urea cycle, waste ammonia, in the form of the ammonium ion, is normally condensed with bicarbonate and ATP to form carbamoyl phosphate which undergoes several more reactions, including one leading to the synthesis of arginine, and ultimate transformation to urea for excretion. Thus, in defects of this cycle ammonia accumulates and arginine synthesis is deficient.[3] Hyperammonaemia is most severe when the enzyme defect occurs in the early steps of the urea cycle, such as in CPS or OTC deficiency, and is less severe at later stages, as in ASL or arginase deficiency.[2] Hyperammonaemia is often associated with respiratory alkalosis in patients with urea cycle disorders.[3]

The basis of treatment is dietary protein restriction, to decrease the requirement for waste nitrogen synthesis,[4] and the use of drugs to stimulate alternative pathways of waste nitrogen excretion.[5,6] These include arginine, citrulline, sodium benzoate, sodium phenylacetate, and sodium phenylbutyrate. In the initial management of severe hyperammonaemia, haemodialysis is preferred over peritoneal dialysis because it is more effective.[3,7]

Arginine supplements are given except in hyperargininaemia.[5,7] Citrulline may be used in some cases instead;[8] it may be useful for CPS and OTC deficiency (in doses of about 170 mg/kg daily or 3.8 g/m^2 daily),[5,6,9] but it is not recommended for patients with ASS or ASL deficiency, as levels of citrulline are already elevated.[5,10] Some recommend citrulline with arginine in acute hyperammonaemia to aid additional removal of nitrogen.[9] For the treatment of acute hyperammonaemia, some recommend a loading dose of arginine 600 mg/kg over 90 minutes pending definitive diagnosis.[3,10] Alternatively, a loading dose of 200 mg/kg or 4 g/m^2 has been advocated for CPS or OTC deficiency,[6,9,10] and 600 mg/kg or 12 g/m^2 for ASS or ASL deficiency.[6,9,10] The same dose as the loading dose is then given over 24 hours, as a constant maintenance infusion,[6,9,10] until conversion to oral medication is made.[10] For long-term management of ASS or ASL deficiency, doses of arginine ranging from 400 to 700 mg/kg daily have been recommended.[5,6,9,10]

Patients also receive treatment with sodium benzoate and sodium phenylacetate[6,10] or sodium phenylbutyrate.[5,6] ASL deficiency can be managed with protein restriction and arginine alone,[6,11] although some still advocate the use of sodium phenylbutyrate.[5,8] When sodium benzoate is conjugated with glycine and excreted as hippuric acid it provides an alternative pathway of nitrogen excretion, while sodium phenylacetate and sodium phenylbutyrate provide a second and even more effective pathway by conjugation with glutamine.[6,7,10] Some consider intravenous sodium benzoate and sodium phenylacetate the treatment of choice in acute hyperammonaemia; sodium phenylbutyrate is recommended for chronic management.[9] In a 25-year, open-label, uncontrolled study, intravenous therapy with sodium phenylacetate and sodium benzoate clearly improved survival in patients with acute hyperammonaemia, with an overall survival rate of 84%; survival was also related to peak plasma ammonium concentration and age. Haemodialysis was also used to control hyperammonaemia, especially in neonates and older patients who were less responsive to intravenous therapy.[12]

It has been suggested that carnitine supplementation (at 100 mg/kg daily[9] either orally or intravenously) should be added to minimise neurological symptoms and toxicity, but its value is uncertain.[4,13] Low carnitine levels have been reported to be uncommon in patients with urea cycle disorders and, in patients treated with sodium benzoate, benzoyl carnitine may form, negating any potential benefit from carnitine supplementation.[8]

Liver transplantation (p.1815) may achieve long-term correction of urea cycle disorders, even in the very young patient, and gene replacement therapy is under investigation.[14]

Hyperammonaemia and hepatic encephalopathy (p.1697) can also arise from other causes[7,13] for which arginine may not be advocated. Carglumic acid (p.2277) is the treatment of choice for patients with hyperammonaemia arising from NAGS deficiency.

1. Summar M, Tuchman M. Proceedings of a consensus conference for the management of patients with urea cycle disorders. *J Pediatr* 2001; **138** (suppl): S6–S10.
2. Shih VE. Alternative-pathway therapy for hyperammonemia. *N Engl J Med* 2007; **356:** 2321–2.
3. The Urea Cycle Disorders Conference Group. Consensus statement from a conference for the management of patients with urea cycle disorders. *J Pediatr* 2001; **138** (suppl): S1–S5.
4. Leonard JV. The nutritional management of urea cycle disorders. *J Pediatr* 2001; **138** (suppl): S40–S45.
5. Berry GT, Steiner RD. Long-term management of patients with urea cycle disorders. *J Pediatr* 2001; **138** (suppl): S56–S61.
6. Batshaw ML, *et al.* Alternative pathway therapy for urea cycle disorders: twenty years later. *J Pediatr* 2001; **138** (suppl): S46–S55.
7. Leonard JV, Morris AAM. Urea cycle disorders. *Semin Neonatol* 2002; **7:** 27–35.
8. Wilcken B. Problems in the management of urea cycle disorders. *Mol Genet Metab* 2004; **81** (suppl): S86–S91.
9. Kleppe S, *et al.* Urea cycle disorders. *Curr Treat Options Neurol* 2003; **5:** 309–19.
10. Summar M. Current strategies for the management of neonatal urea cycle disorders. *J Pediatr* 2001; **138** (suppl): S30–S39.
11. Brusilow SW, *et al.* Treatment of episodic hyperammonemia in children with inborn errors of urea synthesis. *N Engl J Med* 1984; **310:** 1630–4.
12. Enns GM, *et al.* Survival after treatment with phenylacetate and benzoate for urea-cycle disorders. *N Engl J Med* 2007; **356:** 2282–92.
13. Leonard JV, Morris AAM. Inborn errors of metabolism around time of birth. *Lancet* 2000; **356:** 583–7.
14. Lee B, Goss J. Long-term correction of urea cycle disorders. *J Pediatr* 2001; **138** (suppl): S62–S71.

Hypotensive action. Arginine is the physiological precursor of nitric oxide and this has been suggested as an explanation for the hypotensive effect that has been reported in healthy subjects[1-3] and hypertensive patients[1,4] given infusions of arginine, although effects unrelated to nitric oxide generation cannot be excluded.[4]

Oral arginine has also been reported to significantly decrease mean systolic blood pressure in hypertensive patients,[5] in patients on haemodialysis, and in renal transplant recipients.[6] In patients with essential hypertension, a single dose of arginine by mouth had no effect on blood pressure, although it did improve endothelium-dependent flow-mediated dilatation of the brachial artery compared with placebo.[7] In patients with pulmonary hypertension, short-term use of arginine has reduced pulmonary arterial pressure.[8-10]

In pregnant women with pre-eclampsia (see Hypertension, p.1171), plasma-arginine concentrations were found to be markedly reduced compared with control subjects.[11] Arginine infusions of 20 g, given to women with mild to moderate gestational hypertension,[12] and 30 g given to pre-eclamptic women,[13] significantly reduced systolic and diastolic blood pressure, with no adverse effect on fetal heart rate in the one study.[12] In a study of pre-eclamptic women given arginine 12 g daily for 2 days by mouth, no significant differences in diastolic blood pressure were seen compared with those receiving placebo.[14] However, in another study of pre-eclamptic women given 3 g arginine daily for 3 weeks, systolic, diastolic and mean arterial pressure were significantly reduced compared with those taking placebo.[15]

Because of apparent improvement in endothelial function with arginine, some interest has surrounded its potential role in other cardiovascular diseases, such as coronary artery disease and heart failure.[16] Decrease in plasma-cholesterol concentrations has also been reported in 2 hypercholesterolaemic patients given arginine infusions.[17] However, long-term supplementation was found not to be helpful (and possibly harmful) in patients with peripheral arterial disease,[18] and arginine therapy has been implicated in increased mortality when given to patients after myocardial infarction (see under Adverse Effects and Precautions, above).

1. Nakaki T, *et al.* L-arginine-induced hypotension. *Lancet* 1990; **336:** 696.
2. Hishikawa K, *et al.* L-arginine-induced hypotension. *Lancet* 1991; **337:** 683–4.
3. Petros AJ, *et al.* L-arginine-induced hypotension. *Lancet* 1991; **337:** 1044–5.
4. Pedrinelli R, *et al.* Pressor, renal and endocrine effects of -arginine in essential hypertensives. *Eur J Clin Pharmacol* 1995; **48:** 195–201.
5. Palloshi A, *et al.* Effect of oral -arginine on blood pressure and symptoms and endothelial function in patients with systemic hypertension, positive exercise tests, and normal coronary arteries. *Am J Cardiol* 2004; **93:** 933–5.
6. Kelly BS, *et al.* Oral arginine improves blood pressure in renal transplant and hemodialysis patients. *J Parenter Enteral Nutr* 2001; **25:** 194–202.
7. Lekakis JP, *et al.* Oral -arginine improves endothelial dysfunction in patients with essential hypertension. *Int J Cardiol* 2002; **86:** 317–23.
8. Mehta S, *et al.* Short-term pulmonary vasodilation with -arginine in pulmonary hypertension. *Circulation* 1995; **92:** 1539–45.
9. Nagaya N, *et al.* Short-term oral administration of -arginine improves hemodynamics and exercise capacity in patients with precapillary pulmonary hypertension. *Am J Respir Crit Care Med* 2001; **163:** 887–91.
10. Morris CR, *et al.* Arginine therapy: a new treatment for pulmonary hypertension in sickle cell disease? *Am J Respir Crit Care Med* 2003; **168:** 63–9.
11. D'Aniello G, *et al.* Plasma -arginine is markedly reduced in pregnant women affected by preeclampsia. *J Chromatogr B Biomed Sci Appl* 2001; **753:** 427–31.
12. Neri I, *et al.* Effects of acute L-arginine infusion on non-stress test in hypertensive pregnant women. *J Matern Fetal Neonatal Med* 2004; **16:** 23–6.
13. Facchinetti F, *et al.* -Arginine infusion reduces blood pressure in preeclamptic women through nitric oxide release. *J Soc Gynecol Investig* 1999; **6:** 202–7.
14. Staff AC, *et al.* Dietary supplementation with -arginine or placebo in women with pre-eclampsia. *Acta Obstet Gynecol Scand* 2004; **83:** 103–7.
15. Rytlewski K, *et al.* Effects of prolonged oral supplementation with -arginine on blood pressure and nitric oxide synthesis in preeclampsia. *Eur J Clin Invest* 2005; **35:** 32–7.
16. Cheng JWM, Balwin SN. L-arginine in the management of cardiovascular diseases. *Ann Pharmacother* 2001; **35:** 755–64.
17. Korbut R, *et al.* Effect of -arginine on plasminogen-activator inhibitor in hypertensive patients with hypercholesterolemia. *N Engl J Med* 1993; **328:** 287–8.
18. Wilson AM, *et al.* L-arginine supplementation in peripheral arterial disease: no benefit and possible harm. *Circulation* 2007; **116:** 188–95.

Necrotising enterocolitis. A systematic review[1] considered that although there was evidence suggesting that supplementation of the feed of premature neonates with arginine could prevent the development of necrotising enterocolitis (p.173), it was insufficient to recommend the practice without further study.

1. Shah P, Shah V. Arginine supplementation for prevention of necrotising enterocolitis in preterm infants. Available in The Cochrane Database of Systematic Reviews; Issue 3. Chichester: John Wiley; 2007 (accessed 24/06/08).

Preparations

BP 2008: Arginine Hydrochloride Intravenous Infusion;
USP 31: Arginine Hydrochloride Injection.

Proprietary Preparations (details are given in Part 3)
Arg.: Inteligen†; Laclorene; ***Austria:*** Sangenor; ***Braz.:*** Reforgan; Targifor; ***Fr.:*** Dynamisan; Energitum†; Eucol; Pargine; Sargenor; Tiadilon; ***Ger.:*** Eubiol†; ***Israel:*** Carginine†; ***Ital.:*** Bioarginina; Dynamisan; Sargenor; Sulfile†; ***Malaysia:*** Arginitric; ***Port.:*** Asparten; Bio-Energol Plus; Pan-Astenico R; Sargenor; Sulfile; ***Spain:*** Potenciator; Sargenor; Sargisthene; Sorbenor; ***Switz.:*** Dynamisan; ***USA:*** R-Gene.

Multi-ingredient: ***Arg.:*** Acrea; Holomagnesio Vital; Inteligen Ginseng†; ***Austria:*** Leberinfusion; Rocmaline; ***Braz.:*** Dinavital C; Ornihepat†; Ornitargin; Targifor C; ***Chile:*** Ureadin 30; ***Cz.:*** Citrarginе†; ***Fr.:*** Arginotri-B; Citrarginine†; Epuram†; Fastenyl; Hepagrume; Hepargitol; Rocmaline; Sargenor a la Vitamine C; ***Ger.:*** Glutarsin E†; Polilevo N†; ***Hung.:*** Glutarsin E; Rocmalat†; ***Indon.:*** Sirec; ***Ital.:*** Calciofix; Glutargin†; Ipoazotal Complex; Ipoazotal†; Isoram; Linfoiodine; Polilevo†; Sargenor Plus; Somatron; Tonoplus†; Vitasprint Complex†; ***Spain:*** Dynamogen; Sanieb†; ***Switz.:*** Activital Forte; Arginotri-B; Vitasprint Complex.

Arrowroot

Amylum Marantae; Araruta; Arruruz; Maranta; Pfeilwurzelmehl; Sagú del monte; Yuquilla silvestre.

Profile

Arrowroot consists of the starch granules of the rhizomes of *Maranta arundinacea* (Marantaceae). It has the general properties of starch (p.1968). It has been used as a suspending agent in the preparation of barium meals and has sometimes been used in place of starch in tablet manufacture.

Diarrhoea. In a pilot study in 11 patients with irritable bowel syndrome given 10 mL arrowroot powder three times daily for 1 month, 4 patients reported an improvement in diarrhoea.[1]

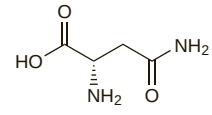
1. Cooke C, *et al.* Arrowroot as a treatment for diarrhoea in irritable bowel syndrome patients: a pilot study. *Arq Gastroenterol* 2000; **37:** 20–4.

Asparagine Monohydrate

L-α-Aminosuccinamic Acid Monohydrate; Asparagiinimonohydraatti; Asparagin monohydrát; Asparagina, monohidrato de; Asparaginas monohidratas; L-Asparagine Monohydrate; Asparagine monohydratée; Asparaginmonohydrat; Asparaginum monohydricum; Asparamide; Aspartamic acid; Aspartic acid beta-amide; N (asparagine); NSC-82391. (2*S*)-2,4-Diamino-4-oxobutanoic acid monohydrate.

$C_4H_8N_2O_3,H_2O$ = 150.1.

CAS — 70-47-3 (anhydrous asparagine); 5794-13-8 (asparagine monohydrate).



(anhydrous asparagine)

Pharmacopoeias. In *Chin.* and *Eur.* (see p.vii). Also in *USNF*, which specifies the anhydrous form or the monohydrate.