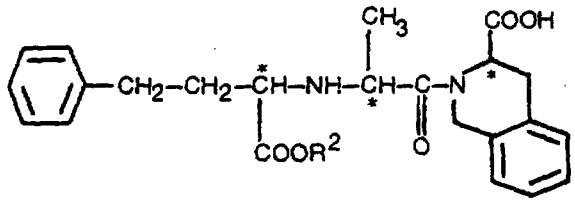
Description

This invention relates to certain salts of substituted acyl derivatives of 1,2,3,4-tetrahydroisoquinoline-3-carboxylic acid compounds, pharmaceutical compositions containing the salts, and the production of the same.

One aspect of the present invention provides substituted acyl derivatives of 1,2,3,4-tetrahydroisoquinoline-3-carboxylic acid compounds having the following general formula:



in the form of the (S,S,S) isomer, where R^2 is a hydrogen atom or an ethyl radical, in one of the following acid salt forms: the hydrochloride, hydrate; the hydrochloride, hemihydrate; and the hydrochloride.

This invention, therefore, relates to the above pharmaceutically acceptable acid salts of

2-[2-(1-carboxy-3-phenylpropyl)amino]-1-oxopropyl]-1,2,3,4-tetrahydro-3-isoquinolinecarboxylic acid; and

2-[2-[[1-(ethoxycarbonyl)-3-phenylpropyl]amino]-1-oxopropyl]-1,2,3,4-tetrahydro-3-isoquinoline-carboxylic acid;

The compounds of the present invention of formula I have asymmetric carbon atoms indicated by asterisks. The 1,2,3,4-tetrahydroisoquinoline-3-carboxylic acid used in the present invention has the L (S) configuration.

This configuration has been shown to be required for biological activity, and thus active compounds of the invention are derived from either L(-) or DL-1,2,3,4-tetrahydroisoquinoline-3-carboxylic acid.

Optical and diastereo isomers arising from the chirality at the centres marked with an asterisk in formula I. The S configuration at these centres is required.

The compounds of the present invention of formula I may be prepared from 1,2,3,4-tetrahydroisoquinoline-3-carboxylic acid by first protecting the carboxylic acid group, preferably as an ester, e.g. with a lower alkyl, benzyl or trimethylsilyl group. The protected carboxylic acid compound is coupled to an N-protected amino acid, e.g. glycine or L-alanine, protected on its nitrogen atom, conveniently with *t*-butoxycarbonyl or benzyloxycarbonyl. The coupling may be carried out by any of a variety of standard peptide coupling techniques as disclosed, for example, in "The Peptides. Analysis, Synthesis, Biology, Vol. 1 Major Methods of Peptide Bond Formation, Part A", ed. E. Gross, J. Meierhofer, Academic Press N.Y. (1979). An especially useful method involves the use of a dehydrating agent, such as dicyclohexylcarbodiimide alone or in the presence of a reagent forming a reactive ester, e.g. 1-hydroxy-benztriazole, in a suitable aprotic solvent such as dimethylformamide, acetonitrile, tetrahydrofuran or a chlorinated hydrocarbon. This gives the intermediate (N-protected-2-aminoacyl)-1,2,3,4-tetrahydroisoquinoline-3-carboxylic acid esters. These may then be either partially or totally deblocked depending on the protecting groups chosen, using anhydrous acids, e.g. hydrochloric acid in acetic acid or trifluoroacetic acid in methylene chloride, or hydrogen gas and a catalyst to give the intermediate dipeptide either in free form or protected as a desired ester.

The compounds of the present invention of formula I may then be prepared by reacting the intermediate dipeptide or its ester derivative with α-keto-4-substituted phenylbutyric acid or its lower alkyl ester derivatives under dehydrating and reducing conditions. Preferred dehydrating agents include molecular seives in aprotic solvents and preferred reducing agents include sodium cyanoborohydride or hydrogen gas with a catalyst.

Alternatively, the dipeptide or its ester derivative may be reacted with an α-halo-4-substituted phenylbutyric acid or its ester in the presence of a suitable basic reagent, such as triethylamine or alkali carbonates or bicarbonates, in a solvent, to give the compounds of the present invention of formula I. Ester-protected products may be hydrolysed under basic or acidic reaction conditions to free acid derivatives, or, in the case of benzyl esters, catalytic hydrogenolysis may be preferred.

Alternatively, compounds of the present invention of formula I may be prepared in a different manner. This consists of applying either of the two methods described above for the attachment of the 2-(4-phenylbutyric acid) moiety to the protected dipeptide, first to glycine or L-alanine, which may be protected as an ester, to give N-[2-(4-phenylbutyric acid)]-substituted glycine or L-alanine derivative.

After selective deblocking of the acid moiety on the glycine or alanine portion of the product, the resulting monoacid may be coupled, either directly or subsequent to suitable blocking of the amino group, via standard peptide coupling procedures to the 1,2,3,4-tetrahydro-3-isoquinoline carboxylate, protected as an ester. Selective or complete removal of the ester groups and any amine protecting groups yields the compounds of formula 1.

The products are obtained typically as a mixture of diastereoisomers which can be separated by standard methods of fractional crystallization or chromatography.

The acid salts of the present invention are formed by conventional reactions by reacting the free amino acid or amino ester form of the product with one or more equivalents of the appropriate acid, providing the desired anion in a solvent or medium in which the salt is insoluble, or in water and removing the water by freeze drying. The salts encompassed by the present invention are the hydrochloride, the hydrochloride hydrate and the hydrochloride hemihydrate.

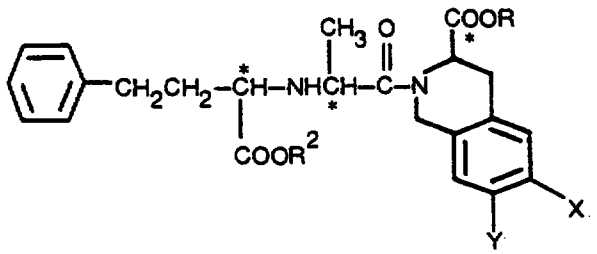
The action of the exzyme renin on angiotensinogen, a pseudoglobulin in blood plasma, produces the decapeptide angiotensin I. Angiotensin I is converted by angiotensin-converting enzyme (ACE) to the octapeptide angiotensin II. The latter is an active pressor substance which has been implicated as the causative agent in various forms of hypertension in various mammalian species, e.g. rats and dogs. The compounds of this invention intervene in the renin→angiotensin I→angiotensin II sequence by inhibiting angiotensin I converting enzyme and reducing or eliminating the formation of the pressor substance angiotensin II, and therefore are useful in reducing or relieving hypertension. Thus by the administration of a composition containing one or a combination of compounds of formula I or pharmaceutically acceptable salts thereof, hypertension in the species of mammal suffering therefrom is alleviated. A single dose or preferably two to four divided daily doses provided on a basis of from 0.1 to 100 mg per kilogram of weight of patient per day, preferably from 1 to 50 mg per kilogram per day, is appropriate to reduce blood pressure. The substance is preferably administered orally, but parenteral routes such as subcutaneusly, intramuscularly, intravenously or intraperitonealy can also be employed.

In vitro ACE Assay

Angiotensin-converting enzyme (ACE) inhibitor activity was determined by assaying guinea pig serum ACE in the presence and absence of the test compound. ACE from guinea pig serum and the test compounds were preincubated for 10 minutes before the addition of the labelled substrate ^{3}H-hippuryl-glycyl-glycine. After a 60 minute incubation of 37°C the reaction was stopped by the addition of 0.1*N* HCl. ACE cleaves the hippuryl-glycyl bond to form the dipeptide glycyl-glycine and ^{3}H-hippuric acid. The ^{3}H-hippuric acid was then extracted with ethyl acetate and the ACE of a given sample calculated as the amount of ^{3}H-hippuric acid generated.

TABLE

Acyl Derivatives of 1,2,3,4-Tetrahydroisoquinoline-3-carboxylic Acids (S,S,S configuration) and their In-Vitro Angiotensin-Converting Enzyme Inhibitory Activity



R	R^2	X	Y	Optical Rotation $[\alpha]_D^{23}$	ACE I Activity (in vitro) IC_{50} Molar Conc.
H	Et	H	H	+10.9° (1.0% EtOH)†	8.3×10^{-9}
H	H	H	H	+14.5° (1.0% MeOH)†	2.8×10^{-9}

† Hydrochloride Salt

The compounds of the invention can be utilized to achieve the reduction of blood pressure by formulating in compositions such as tablets, capsules or elixirs for oral administration or in sterile solutions or suspensions for parenteral administration. About 10 to 500 mg of a compound or mixture of compounds of formula I or physiologically acceptable salt thereof is compounded with a physiologically acceptable vehicle, carrier, excipient binder, preservative, stabilizer, flavor, etc., in a unit dosage form as called for by accepted pharmaceutical practice. The amount of active substance in these compositions or preparations is such that a suitable dosage in the range indicated is obtained.

Illustrative of the adjuvants which may be incorporated in tablets, capsules and the like are the following: a binder such as gum tragacanth, acacia, corn starch or gelatin; an excipient such as dicalcium phosphate; a disintegrating agent such as corn starch, potato starch, alginic acid and the like; a lubricant such as magnesium stearate; a sweetening agent such as sucrose, lactose or saccharin; a flavoring agent

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such as peppermint, oil of wintergreen or cherry. When the dosage unit form is a capsule, it may contain in addition to materials of the above type a liquid carrier such as a fatty oil. Various other materials may be present as coatings or to otherwise modify the physical form of the dosage unit. For instance, tablets may be coated with shellac, sugar or both. A syrup or elixir may contain the active compound, sucrose as a sweetening agent, methyl and propyl parabens as preservatives, a dye and a flavoring such as cherry or orange flavor.

Sterile compositions for injection can be formulated according to conventional pharmaceutical practice by dissolving or suspending the active substance in a vehicle such as water for injection, a naturally occurring vegetable oil like sesame oil, coconut oil, peanut oil, cottonseed oil, etc., or a synthetic fatty vehicle like ethyl oleate or the like. Buffers, preservatives, antioxidants and the like can be incorporated as required.

The invention is illustrated by the following Reference Techniques (RT) and Examples.

Reference Technique 1 (RT1)

2-[2-[[1-(Ethoxycarbonyl)-3-phenylpropyl]amino]-1-oxopropyl]-1,2,3,4-tetrahydro-6,7-dimethoxy-3-isoquinolinecarboxylic Acid, Hydrochloride, Hydrate (S,S,S).

A quantity of 0.0079 mole of the hydrochloride of 2-[2 - [[1 - (ethoxycarbonyl) - 3 - phenylpropyl]amino] - 1 - oxopropyl] - 1,2,3,4 - tetrahydro - 6,7 - dimethoxy - 3 - isoquinolinecarboxylic acid, phenylmethyl ester (S,S,S) dissolved in 100 ml of tetrahydrofuran was catalytically debenzylated with hydrogen and 0.5 g of 20% Pd/carbon at low pressure. The catalyst was filtered off and the product was precipitated as a relatively nonhydroscopic solid by the addition of a 10 fold quantity of ether; wt 3.7 g (88%); mp 120—140°C; tlc (20% MeOH-$CHCl_3$/SiO_2) one spot, Rf 0.5—0.7; $[\alpha]_D^{23}$ = +31.6° (1.05% EtOH).

Anal. Calc'd for $C_{27}H_{34}N_2O_7 \cdot HCl \cdot H_2O$: C, 58.63; H, 6.74; N, 5.07
Found: C, 58.59; H, 6.38; N, 5.06

The noncrystalline diester hydrochloride starting material used above was prepared by treatment of 5.54 g (0.0079 mole) of the maleate salt (prepared by the process of Example 5) with excess saturated sodium bicarbonate, extraction of the free base into 50% ether-ethyl acetate, treatment of this solution with excess hydrogen chloride and concentration at reduced pressure.

Example 1

2-[2-[[1-(Ethoxycarbonyl)-3-phenylpropyl]amino]-1-oxopropyl]-1,2,3,4-tetrahydro-3-isoquinolinecarboxylic Acid, Hydrochloride, Hydrate, (S,S,S).

Procedure A: Debenzylation procedure.

2 - [2 - [[1 - (Ethoxycarbonyl) - 3 - phenylpropyl]amino] - 1 - oxopropyl] - 1,2,3,4 - tetrahydro - 3 - isoquinolinecarboxylic acid, phenylmethyl ester, maleate, (S,S,S) (prepared by the procedure of RT 4) was catalytically debenzylated by the procedure set forth in RT 1 to yield the product: mp 105—120°C; yield, 56%; tlc (20% MeOH-$CHCl_3$/SiO_2) one spot Rf 0.5—0.6; $[\alpha]_D^{23}$ = +10.9° (1.03% EtOH).

Anal. Calc'd for $C_{25}H_{30}N_2O_5 \cdot HCl \cdot H_2O$: C, 60.90; H, 6.75; N, 5.68
Found: C, 61.00; H, 6.37; N, 5.59

Procedure B: Via cleavage of 1,1-dimethylethyl ester.

A quantity of 100 g of trifluoroacetic acid was added to 11.6 g (0.023 mole) of 2 - [2 - [[1 - ethoxycarbonyl) - 3 - phenylpropyl]amino] - 1 - oxopropyl] - 1,2,3,4 - tetrahydro - 3 - isoquinolinecarboxylic acid, 1,1 - dimethylethyl ester (S,S,S) (prepared by the procedure of RT 5). The mixture was stirred to solution and for one hour at room temperature. Most of the trifluoroacetic acid was removed on the rotary evaporator and the remaining traces were removed by the successive additions and removal by rotary evaporation of 2 × 50 ml of THF. The residual oil was dissolved in about 400 ml of dry ether and the hydrochloride was precipitated by addition of a solution of 1.0 g (excess) of dry hydrogen chloride dissolved in 20 ml of dry ether. After filtration and washing with dry ether, the filter cake was dissolved in about 250 ml of water. This solution was filtered through celite and freeze-dried to obtain the product as a partial hydrate; 10.0 g (90%); mp 113—120°C.

Anal. Calc'd for $C_{25}H_{30}N_2O_5 \cdot HCl \cdot \frac{3}{4} H_2O$: C, 61.55; H, 6.70; N, 5.74
Found: C, 61.51; H, 6.49; N, 5.70

Reference Technique 2 (RT 2)

2-[2-[(1-Carboxy-3-phenylpropyl)amino]-1-oxopropyl]-1,2,3,4-tetrahydro-6,7-dimethoxy-3-isoquinolinecarboxylic Acid, Hydrochloride, Hydrate (S,S,S).

A solution of 0.553 g (0.001 mole) of 2 - [2 - [[1 - (ethoxycarbonyl) - 3 - phenylpropyl]amino] - 1 - oxopropyl] - 1,2,3,4 - tetrahydro - 6,7 - dimethoxy - 3 - isoquinolinecarboxylic acid, hydrochloride, hydrate (S,S,S) (prepared by the process of RT 1) in 4 ml (0.004 mole) of 1*N* sodium hydroxide and 4 ml of methanol was allowed to stand at room temperature for 20 hours. The reaction solution was added to 5 ml of 1*N* hydrochloric acid and concentrated at reduced pressure. The last amounts of water were removed by two successive additions and removal at reduced pressure of 25 ml portions of ethanol. The organic portion of the residue was dissolved in 0.5 ml of methanol. Chloroform (30 ml) was added and the solution

was dried over sodium sulfate, charcoaled, filtered, and concentrated to give 0.45 g product. This amorphous material was dissolved in 20 ml of tetrahydrofuran and 100 ml of ether was added to precipitate a near white solid product; wt 0.4 g; mp 145—170°C; yield, 80%; tlc (20% MeOH-$CHCl_3$/SiO_2) Rf 0.1; $[\alpha]_D^{23}$ = +37.8° (1.09% MeOH).

Anal. Calc'd for $C_{25}H_{30}N_2O_7 \cdot HCl \cdot H_2O$: C, 57.19; H, 6.34; N, 5.34
Found: C, 57.17; H, 6.10; N, 5.51

Example 2

2-[2-[(1-Carboxy-3-phenylpropyl)amino]-1-oxopropyl]-1,2,3,4-tetrahydro-3-isoquinolinecarboxylic Acid, Hydrochloride, Hemihydrate (S,S,S).

2 - [2 - [[1 - (Ethoxycarbonyl) - 3 - phenylpropyl]amino] - 1 - oxopropyl] - 1,2,3,4 - tetrahydro - 3 - isoquinolinecarboxylic acid, hydrochloride, hydrate (S,S,S) was treated by the procedure set forth in RT 2 to yield the product; mp 140—170°C; yield, 39%; $[\alpha]_D^{23}$ = +14.5° (1.08% MeOH).

Anal. Calc'd for $C_{23}H_{26}N_2O_5 \cdot HCl \cdot \frac{1}{2} H_2O$: C, 60.59; H, 5.97; N, 6.15; Cl, 7.77
Found: C, 60.68; H, 6.04; N, 5.89; Cl, 7.04

Reference Technique 3 (RT 3)

2-[2-[[1-(Ethoxycarbonyl)-3-phenylpropyl]amino]-1-oxopropyl]-1,2,3,4-tetrahydro-6,7-dimethoxy-3-isoquinolinecarboxylic Acid, Phenylmethyl Ester, Maleate (S,S,S).

A stirred solution of 5.0 g (0.0158 mole) of ethyl α-[(1-carboxyethyl)amino]benzenebutanoate hydrochloride (S,S) (prepared by the process of RT 6) in 200 ml of methylene chloride was treated successively with 1.60 g (0.0158 mole) of triethylamine, 2.14 g (0.0158 mole) of 1-hydroxybenzotriazole, 5.16 g (0.0158 mole) of 1,2,3,4-tetrahydro-6,7-dimethoxy-3-isoquinolinecarboxylic acid, phenylmethyl ester free base (S-form) (prepared by the process of RT 7); and then with 3.26 g (0.0158 mole) of dicyclohexylcarbodiimide in 10 ml of methylene dichloride. Dicyclohexylurea gradually separated. The mixture was allowed to stand at room temperature overnight. Hexane (300 ml) was added and the urea was filtered. The filtrate was washed with 250 ml of saturated sodium bicarbonate, dried over sodium sulfate and concentrated to remove solvent. The viscous residue was triturated with 50 ml of ether and filtered to remove insolubles. The filtrate was concentrated to give 9.2 g (99%) of crude base.

Preparation of maleate salt: A solution of 9.0 g (0.015 mole) of the above crude base in 50 ml of ethyl acetate was treated with a warm (40°C) solution of 1.86 g (0.016 mole) of maleic acid in 50 ml of ethyl acetate. White crystals separated; wt 7.2 g (65%); mp 139—141°C; tlc of base (generated with aq. sodium bicarbonate treatment of the salt and ethyl acetate extraction) showed one spot, Rf 0.7 (EtOAc/SiO_2). Recrystallization from ethyl acetate gave pure material of the same mp; $[\alpha]_D^{23}$ = +3.4° (1.05% EtOH).

Anal. Calc'd for $C_{34}H_{40}N_2O_7 \cdot C_4H_4O_4$: C, 64.74; H, 6.29; N, 3.98
Found: C, 64.48; H, 6.30; N, 3.99

Reference Technique 4 (RT 4)

2-[2-[[1-(Ethoxycarbonyl)-3-phenylpropyl]amino]-1-oxopropyl]-1,2,3,4-tetrahydro-3-isoquinolinecarboxylic Acid, Phenylmethyl Ester, Maleate (S,S,S,).

Ethyl α-[(1-carboxyethyl)amino]benzenebutanoate hydrochloride (S,S) (prepared by the process of RT 6) was coupled with 1,2,3,4-tetrahydro-3-isoquinolinecarboxylic acid, phenylmethyl ester free base (S-form) (prepared by the process of Example 10) by the same procedure used in Example 5; yield, 61%; mp 151—153°C (recrystallized from ethyl acetate); tlc of base showed one spot, Rf 0.8 (EtOAc/SiO_2); $[\alpha]_D^{23}$ = −11.7° (1.0% MeOH).

Anal. Calc'd for $C_{32}H_{36}N_2O_5 \cdot C_4H_4O_4$: C, 67.07; H, 6.25; N, 4.35
Found: C, 66.58; H, 6.09; N, 4.25

Reference Technique 5 (RT 5)

2-[2-[[1-Ethoxycarbonyl)-3-phenylpropyl]amino]-1-oxopropyl]-1,2,3,4-tetrahydro-3-isoquinolinecarboxylic Acid, 1,1-Dimethylethyl Ester (S,S,S).

A mixture of 8.38 g (0.03 mole) of ethyl α-[(1-carboxyethyl)amino]benzenebutanoate (free amino acid) (S,S) (prepared by the process of RT 6), 8.09 g (0.03 mole) of 1,2,3,4-tetrahydro-3-isoquinolinecarboxylic acid, 1,1-dimethylethyl ester hydrochloride (S-form) (prepared by the process of RT 9), 4.05 g (0.03 mole) of 1-hydroxybenzotriazole and 250 ml of THF was cooled in an ice bath to 3—5°C. With stirring, 3.04 g (0.03 mole) of triethylamine was added, then a solution of 6.92 g (0.0335 mole) of dicyclohexylcarbodiimide in 30 ml of THF was dropped in slowly over 20 minutes. The reaction mixture was stirred at 3—5°C for one hour. The ice bath was removed, and the reaction mixture stirred an additional 3 hours. The separated mixture of triethylamine hydrochloride and dicyclohexylurea was removed by filtration and washed with THF. The filtrate was evaporated on the rotary evaporation to remove all volatiles. The resulting gum was dissolved in about 300 ml of ethyl acetate. After filtration through celite the ethyl acetate solution was extracted 2 times with 100 ml of saturated sodium bicarbonate solution, once with 75 ml of 2N citric acid solution, once with 100 ml of saturated sodium bicarbonate solution and once with 100 ml of saturated sodium chloride solution. After drying with anhydrous $MgSO_4$ and filtration, the ethyl acetate was removed on the rotary evaporator to yield 16.9 g of a light brown gum. This gum was dissolved in 350 ml of boiling

hexane and decanted through celite. The hexane solution was cooled in ice, seeded and stirred until crystallization was well established. The product was filtered, washed with cold hexane and dried; wt 11.6 g (78%); mp 68.5—71°C; $[\alpha]_D^{23} = -12.2°$ (2% MeOH). Pure material had mp 71—72°C; $[\alpha]_D^{23} = -12.6$ (2% MeOH). The maleate salt had mp 127.5—128.5°C; $[\alpha]_D^{23} = +46.4$ (2% MeOH).

Reference Technique 6 (RT 6)

Ethyl α-[(1-Carboxyethyl)amino]benzenebutanoate Hydrochloride (S,S).

A solution of 2.0 g of t-butyl alanine (S-form) and 3.78 g of ethyl 2-bromo-4-phenylbutanoate in 25 ml of dimethylformamide was treated with 1.8 ml of triethylamine and the solution was heated at 70°C for 18 hours. The solvent was removed at reduced pressure and the residue was mixed with water and extracted with ethyl ether. The organic layer was washed with water and dried over magnesium sulfate. Concentration of the solvent at reduced pressure gave the oily t-butyl ester of the intermediate which was found to be sufficiently pure by gas liquid chromatography for further use.

A solution of 143.7 g of this t-butyl ester in 630 ml of trifluoroacetic acid was stirred at room temperature for one hour. The solvent was removed at reduced pressure and the residue was dissolved in ethyl ether and again evaporated. This operation was repeated. Then the ether solution was treated dropwise with a solution of hydrogen chloride gas in ethyl ether until precipitation ceased. The solid, collected by filtration, was a mixture of diastereoisomers, mp 153—165°C, $[\alpha]_D^{23} = +3.6°$ (1% MeOH).

In order to separate the preferred *S, S* isomer, a suspension of 10.0 g of the mixture in 200 ml of methylene chloride was stirred at room temperature for five minutes and filtered; the solid was washed with additional methylene chloride and finally ether. The solid material, mp 202—208°C (dec.), $[\alpha]_D^{23} = -29.3°$ (1% MeOH) was the less preferred diastereoisomer having the *R, S* configuration (*S* referring to the portion derived from L-alanine). The preferred *S, S* diastereoisomer was recovered from the filtrate after concentration and trituration of the residue with ether; mp 137—139°C; $[\alpha]_D^{23} = +31.3°$ (1% MeOH).

The free amino acid (S,S-form) was prepared by treatment of an aqueous solution of the hydrochloride with saturated sodium acetate. The product was filtered, washed efficiently with cold water and recrystallized from ethyl acetate; mp 149—151°C; $[\alpha]_D^{23} = +29.7°$ (1% 0.1N HCl).

Reference Technique 7 (RT 7)

1,2,3,4-Tetrahydro-6,7-dimethoxy-3-isoquinolinecarboxylic Acid, Phenylmethyl Ester, Hydrochloride (S-form).

A mixture of 1,2,3,4-tetrahydro-6,7-dimethoxy-3-isoquinolinecarboxylic acid, hydrochloride (S-form) and 600 ml of benzyl alcohol was saturated with hydrogen chloride gas. The temperature rose to 45°C. The mixture was stirred at room temperature for three days. A relatively small amount of solid was filtered off and the filtrate was treated with ca 2-liters of ether to precipitate crude product; wt 37.5 g; yield, 83%. Purification was effected by treatment with excess saturated sodium bicarbonate, extraction of base into ethyl acetate and precipitation of hydrochloride salt with HCl gas. Recrystallization from methanol-ether gave pure product; mp 255—260°C; $[\alpha]_D^{23} = -81.3°$ (1.0% MeOH); tlc (20% MeOH-$CHCl_3$/SiO_2) one spot Rf 0.8.

Anal. Calc'd for $C_{19}H_{21}NO_4 \cdot HCl$: C, 62.72; H, 6.10; N, 3.85
Found: C, 62.54; H, 5.99; N, 4.00

Reference Technique 8 (RT 8)

1,2,3,4-Tetrahydro-3-isoquinolinecarboxylic Acid, Phenylmethyl Ester, Hydrochloride (S-form).

Benzyl alcohol, 750 ml, was treated with 150 g of commercial polyphosphoric acid and warmed and stirred at 90°C to obtain a homogeneous mixture. Solid 1,2,3,4-tetrahydro-3-isoquinolinecarboxylic acid (S-form) 165.2 g was added. The mixture was stirred 4 hours at 95—105°C and then allowed to stand at room temperature for 18 hours. A solution of 18.5 g gaseous hydrochloric acid in 2.5 l of anhydrous ether was added, and the product separated slowly on cooling overnight. Filtration gave the crude benzyl 1,2,3,4-tetrahydro-3-isoquinoline carboxylate hydrochloride. This was purified by recrystallization from ethanol twice to give material with mp 190.5—191°C; $[\alpha]_D^{23} = -83.3°$ (1% 1:1 methanol/1N hydrochloric acid.

Reference Technique 9 (RT 9)

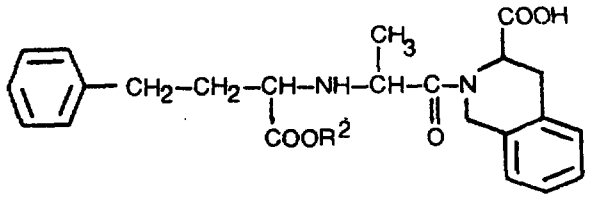
1,2,3,4-Tetrahydro-3-isoquinolinecarboxylic Acid, 1,1-Dimethylethyl Ester Hydrochloride (S-form).

This compound was prepared by passing 447 g of isobutylene into a 0°C solution of 63.5 g of 1,2,3,4-tetrahydro-3-isoquinoline carboxylic acid (S-form) in 650 ml of dry dioxane and 65 ml of concentrated sulfuric acid under nitrogen. The reaction vessel was sealed and shaken for 17 hours at room temperature. The reaction vessel was vented and the mixture was poured into 25 l of cold 2N sodium hydroxide. The product is extracted into ether. The ether solution was washed with water, dried, and concentrated to about 500 ml. This was treated with excess 6N isopropanolic hydrochloric acid to precipitate the product, which was collected by filtration. A sample purified by recrystallization from ethanol/ether had mp 190—192°C (dec.), $[\alpha]_D^{23} = -88.7°$ (2% MeOH).

(15)

Claims for the Contracting States: BE CH DE FR GB IT LI LU NL SE

1. A substituted acyl derivative of 1,2,3,4-tetrahydroisoquinone-3-carboxylic acid in the form of the (S,S,S) iscmer having the following general formula:



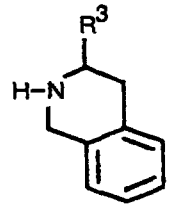
where R^2 is a hydrogen atom or an ethyl radical, in one of the following acid salt forms: the hydrochloride, hydrate; the hydrochloride; and the hydrochloride hemihydrate.

2. A compound according to Claim 1, which is 2 - [2 - [[1 - (ethoxycarbonyl) - 3 - phenylpropyl]amino] - 1 - oxopropyl] - 1,2,3,4 - tetrahydro - 3 - isoquinolinecarboxylic acid, hydrochloride, hydrate (S,S,S).

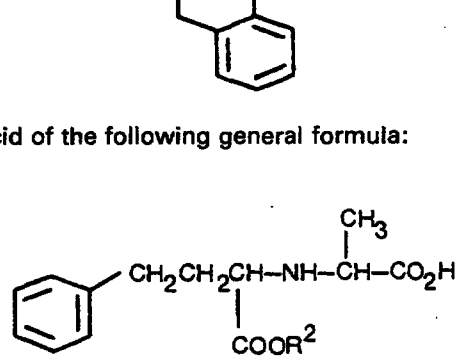
3. A compound according to Claim 1, which is 2 - [2 - [[1 - (ethoxycarbonyl) - 3 - phenylpropyl]amino] - 1 - oxopropyl] - 1,2,3,4 - tetrahydro - 3 - isoquinolinecarboxylic acid, hydrochloride (S,S,S).

4. A compound according to Claim 1, which is 2 - [2 - [(1 - carboxy - 3 - [phenylpropyl)amino] - 1 - oxopropyl] - 1,2,3,4 tetrahydro - 3 - isoquinolinecarboxylic acid, hydrochloride, hemihydrate (S,S,S).

5. A process for producing a pharmaceutically acceptable acid salt as claimed in Claim 1 which process comprises peptide coupling a suitably substituted 1,2,3,4-tetrahydro-3-isoquinoline carboxylate of the following general formula:



with an N-substituted amino acid of the following general formula:

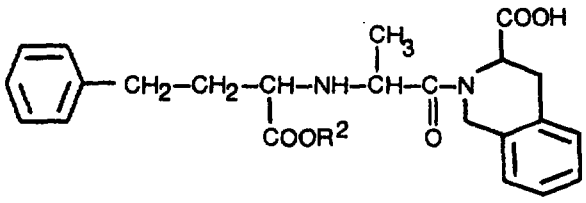


where R^2 is as defined in Claim 1 and R^3 is a suitably blocked carboxylic acid group; and removing the blocking moiety of the carboxylic acid group R^3; and converting the product to the appropriate pharmaceutically acceptable salt thereof.

6. A pharmaceutical composition comprising a pharmaceutically acceptable acid salt as claimed in Claim 1 and a pharmaceutically acceptable carrier therefor.

Claims for the Contracting State: AT

1. A process for producing a substituted acyl derivative of 1,2,3,4-tetrahydroisoquinoline-3-carboxylic acid, in the form of the (S,S,S) isomer, having the following general formula:—

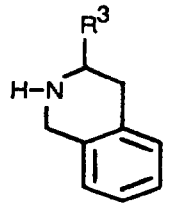


(I)

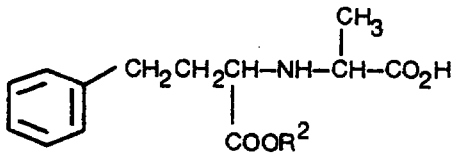
where R^2 is a hydrogen atom or an ethyl radical in one of the following acid salt forms: the hydrochloride,

* C L M S *

hemihydrate; the hydrochloride; and the hydrochloride, hydrate; which process comprises peptide coupling a suitably substituted 1,2,3,4-tetrahydro-3-isoquinoline carboxylate of the following general formula:—



with an N-substituted amino acid of the following general formula:—



where R^2 as defined above and R^3 is a suitably blocked carboxylic acid group; and removing the blocking moiety of the carboxylic acid group R^3; and converting the product into the appropriate pharmaceutically acceptable salt thereof.

2. A process according to Claim 1 which is for producing 2 - [2 - [[1 - (ethoxycarbonyl) - 3 - phenylpropyl]amino] - 1 - oxopropyl] - 1,2,3,4 - tetrahydro - 3 - isoquinolinecarboxylic acid, hydrochloride, hydrate (S,S,S).

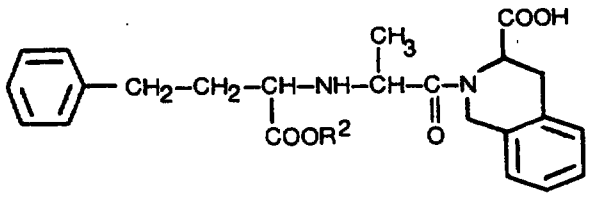
3. A process according to Claim 1, which is for producing 2 - [2 - [[1 - (ethoxycarbonyl) - 3 - phenylpropyl]amino] - 1 - oxopropyl] - 1,2,3,4 - tetrahydro - 3 - isoquinolinecarboxylic acid, hydrochloride (S,S,S).

4. A process according to Claim 1 which is for producing 2 - [2 - [(1 - carboxy - 3 - [phenylpropyl)amino] - 1 - oxopropyl] - 1,2,3,4 - tetrahydro - 3 - isoquinolinecarboxylic acid, hydrochloride, hemihydrate (S,S,S).

5. A process for producing a pharmaceutical composition comprising a pharmaceutically acceptable salt prepared by a process as claimed in any preceding claim and a pharmaceutically acceptable carrier; which process comprises incorporating the pharmaceutically acceptable salt in a suitable carrier.

Patentansprüche für die Vertragsstaaten: BE CH DE FR GB IT LI LU NL SE

1. Substituiertes Acylderivat der 1,2,3,4-Tetrahydroisochinolin-3-carbonsäure in Form des (S,S,S)-Isomeren mit der folgenden allgemeinen Formel



(I)

worin R^2 ein Wasserstoffatom oder ein Äthylradikal bedeutet, in einer der folgenden Säuresalzformen: des Hydrochlorid-Hydrats; des Hydrochlorids; und des Hydrochlorid-Hemihydrats.

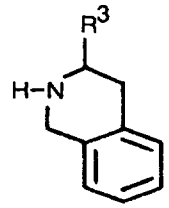
2. Verbindung nach Anspruch 1, die 2 - [2 - [[1 - (Äthoxycarbonyl) - 3 - phenylpropyl] - amino] - 1 - oxopropyl] - 1,2,3,4 - tetrahydro - 3 - isochinolincarbonsäure - Hydrochlorid - Hydrat (S,S,S) ist.

3. Verbindung nach Anspruch 1, die 2 - [2 - [[1 - (Äthoxycarbonyl) - 3 - phenylpropyl] - amino] - 1 - oxopropyl] - 1,2,3,4 - tetrahydro - 3 - isochinolincarbonsäure - Hydrochlorid (S,S,S) ist.

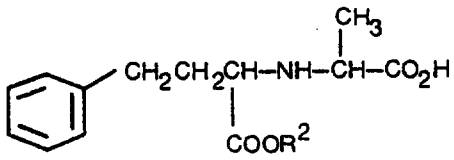
4. Verbindung nach Anspruch 1, die 2 - [2 - [(1 - Carboxy - 3 - phenylpropyl) - amino] - 1 - oxopropyl] - 1,2,3,4 - tetrahydro - 3 - isochinolincarbonsäure - Hydrochlorid - Hemihydrat (S,S,S) ist.

5. Verfahren zur Herstellung eines pharmazeutisch akzeptablen Säuresalzes wie in Anspruch 1 beansprucht, welches Verfahren die Peptidkopplung eines zweckmäßig substituierten 1,2,3,4-Tetrahydro-3-isochinolincarboxylats der folgenden allgemeinen Formel:

* C L M S *



mit einer N-substituierten Aminosäure der folgenden allgemeinen Formel

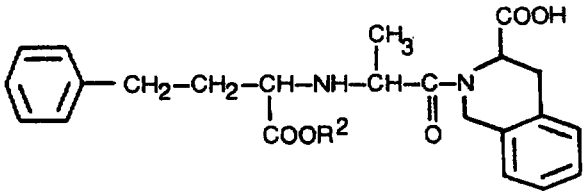


worin R^2 der in Anspruch 1 angeführten Definition entspricht und R^3 eine geeignet geschützte Carbonsäuregruppe bedeutet; und das Entfernen des Schutzteils der Carbonsäuregruppe R^3; und die Überführung des Produkts in das geeignete pharmazeutisch akzeptable Salz desselben umfaßt.

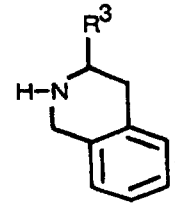
6. Pharmazeutische Zusammensetzung, umfassend ein pharmazeutisch akzeptables Säuresalz, wie in Anspruch 1 beansprucht, und einen pharmazeutisch akzeptablen Träger hiefür.

Patentansprüche für den Vertragsstaat: AT

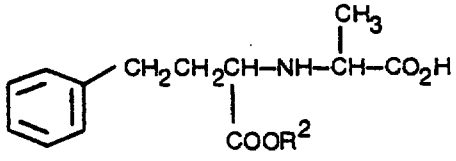
1. Verfahren zur Herstellung eines substituierten Acylderivats der 1,2,3,4-Tetrahydroisochinolin-3-carbonsäure in Form des (S,S,S)-Isomeren, mit der folgenden allgemeinen Formel:



worin R^2 ein Wasserstoffatom oder ein Äthylradikal in einer der folgenden Säuresalzformen bedeutet: des Hydrochlorid-Hemihydrats; des Hydrochlorids; und des Hydrochlorid-Hydrats; welches Verfahren die Peptidkopplung eines zweckmäßig substituierten 1,2,3,4-Tetrahydro-3-isochinolincarboxylats der folgenden allgemeinen Formel:



mit einer N-substituierten Aminosäure der folgenden allgemeinen Formel



worin R^2 der obigen Definition entspricht und R^3 eine geeignet geschützte Carbonsäuregruppe bedeutet; und das Entfernen des Schutzteils der Carbonsäuregruppe R^3; und die Überführung des Produkts in das geeignete pharmazeutisch akzeptable Salz davon umfaßt.

* C L M S *

2. Verfahren nach Anspruch 1, das zur Herstellung des 2 - [2 - [[1 - (Äthoxycarbonyl) - 3 - phenylpropyl] - amino] - 1 - oxopropyl] - 1,2,3,4 - tetrahydro - 3 - isochinolincarbonsäure - Hydrochlorid - Hydrats (S,S,S) dient.

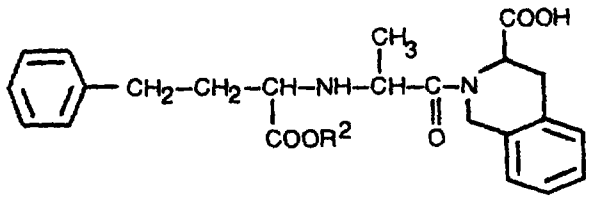
3. Verfahren nach Anspruch 1, das zur Herstellung des 2 - [2 - [[1 - (Äthoxycarbonyl) - 3 - phenylpropyl] - amino] - 1 - oxopropyl] - 1,2,3,4 - tetrahydro - 3 - isochinolincarbonsäure - Hydrochlorids (S,S,S) dient.

4. Verfahren nach Anspruch 1, das zur Herstellung des 2 - [2 - [(1 - Carboxy - 3 - phenylpropyl) - amino] - 1 - oxopropyl] - 1,2,3,4 - tetrahydro - 3 - isochinolincarbonsäure - Hydrochlorid - Hemihydrats (S,S,S) dient.

5. Verfahren zur Herstellung einer pharmazeutischen Zusammensetzung, umfassend ein mittels eines Verfahrens nach einem vorhergehenden Anspruch hergestelltes pharmazeutisch akzeptables Salz und einen pharmazeutisch akzeptablen Träger; welches Verfahren die Inkorporierung des pharmazeutisch akzeptablen Salzes in einem geeigneten Träger umfaßt.

Revendications pour les Etats contractants: BE CH DE FR GB IT LI LU NL SE

1. Un dérivé acyle substitué d'acide 1,2,3,4-tétrahydroisoquinoline-3-carboxylique sous la forme de son isomère (S,S,S) de formule générale suivante:



(I)

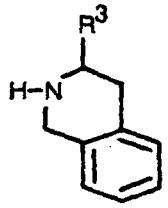
dans laquelle R^2 représente un atome d'hydrogène ou un radical éthyle dans l'une de ses formes de sels d'acides suivantes: le chlorhydrate hydraté, le chlorhydrate et le chlorhydrate hémihydraté.

2. Un composé selon la revendication 1, qui est le chlorhydrate hydraté d'acide 2 - [2 - [[1 - (éthoxycarbonyl) - 3 - phénylpropyl]amino] - 1 - oxopropyl] - 1,2,3,4 - tétrahydro - 3 - isoquinolinecarboxylique (S,S,S).

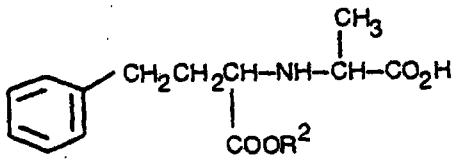
3. Un composé selon la revendication 1, qui est le chlorhydrate d'acide 2 - [2 - [[1 - (éthoxycarbonyl) - 3 - phénylpropyl]amino] - 1 - oxopropyl] - 1,2,3,4 - tétrahydro - 3 - isoquinolinecarboxylique (S,S,S).

4. Un composé selon la revendication 1, qui est le chlorhydrate hémihydraté d'acide 2 - [2 - [[1 - (carboxy) - 3 - phénylpropyl]amino] - 1 - oxopropyl] - 1,2,3,4 - tétrahydro - 3 - isoquinolinecarboxylique (S,S,S).

5. Un procédé de préparation d'un sel d'acide pharmaceutiquement acceptable selon la revendication 1, ce procédé consistant à opérer un couplage peptidique d'un carboxylate convenablement substitué de 1,2,3,4-tétrahydro-3-isoquinoline de formule générale suivante:



avec un amino-acide N-substitué de formule générale suivante:



dans laquelle:

R^2 est tel que défini dans la revendication 1; et

R^3 représente un groupe acide carboxylique convenablement bloqué;

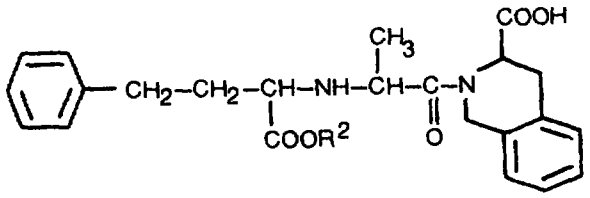
et à éliminer le radical bloquant du groupe R^3 de l'acide carboxylique et à transformer le produit en un de ses sels pharmaceutiquement acceptables approprié.

6. Composition pharmaceutique comprenant un sel d'acide pharmaceutiquement acceptable selon la revendication 1 et un support pharmaceutiquement acceptable de celui-ci.

* C L M S *

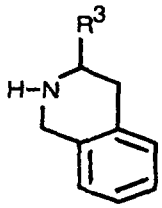
Revendications pour l'Etat contractant: AT

1. Un procédé de préparation d'un dérivé acyle substitué d'acide 1,2,3,4-tétrahydroisoquinoline-3-carboxylique sous la forme de son isomère (S,S,S) de formule générale suivante:

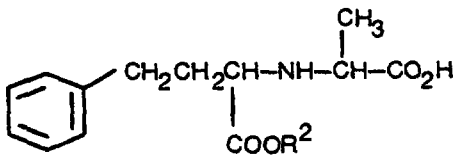


(I)

dans laquelle R^2 représente un atome d'hydrogène ou un radical éthyle sous l'une de ses formes de sels d'acides suivantes: le chlorhydrate hémihydraté, le chlorhydrate et le chlorhydrate hydraté, ce procédé consistant à opérer un couplage peptidique d'un 1,2,3,4-tétrahydro-3-isoquinolinecarboxylique convenablement substitué de formule générale suivante:



par un amino-acide N-substitué de formule générale suivante:



dans laquelle:

R^2 est tel que défini ci-dessus; et

R^3 représente un groupe acide carboxylique convenablement bloqué;

et à éliminer le radical bloquant du groupe R^3 de l'acide carboxylique et à transformer le produit en un de ses sels pharmaceutiquement acceptables approprié.

2. Un procédé selon la revendication 1, destiné à la préparation du chlorhydrate hydraté de l'acide 2 - [2 - [[1 - (éthoxycarbonyl) - 3 - phénylpropyl]amino] - 1 - oxopropyl] - 1,2,3,4 - tétrahydro - 3 - isoquinolinecarboxylique (S,S,S).

3. Un procédé selon la revendication 1, destiné à la préparation du chlorhydrate de l'acide 2 - [2 - [[1 - (éthoxycarbonyl) - 3 - phénylpropyl]amino] - 1 - oxopropyl] - 1,2,3,4 - tétrahydro - 3 - isoquinolinecarboxylique (S,S,S).

4. Un procédé selon la revendication 1, destiné à la préparation du chlorhydrate hémihydraté d'acide 2 - [2 - [[1 - (carboxy) - 3 - phénylpropyl]amino] - 1 - oxopropyl] - 1,2,3,4 - tétrahydro - 3 - isoquinolinecarboxylique (S,S,S).

5. Un procédé de préparation d'une composition pharmaceutique comprenant un sel pharmaceutiquement acceptable préparé par un procédé selon l'une quelconque des revendications précédentes et un support pharmaceutiquement acceptable, ce procédé consistant à incorporer le sel pharmaceutiquement acceptable dans un support convenable.

* C L M S *