FORM 1

COMMONWEALTH OF AUSTRALIA

PATENTS ACT 1952

APPLICATION FOR A STANDARD PATENT

I\We,

FARMITALIA CARLO ERBA S.r.l.

of VIA CARLO IMBONATI, 24
20159 MILAN
ITALY

hereby apply for the grant of a standard patent for an invention entitled:

SOLUTION SYNTHESIS OF AN OCTAPEPTIDE

which is described in the accompanying complete specification

Details of basic application(s):

Number of basic application	Name of Convention country in which basic application was filed	Date of basic application
8723485	GB	07 OCT 87

My/our address for service is care of GRIFFITH HACK & CO., Patent Attorneys, 601 St. Kilda Road, Melbourne 3004, Victoria, Australia.

DATED this 04th day of October 1988

FARMITALIA CARLO ERBA S.r.l.

GRIFFITH HACK & CO.

TO: The Commissioner of Patents.

Forms 7 and 8

AUSTRALIA

Patents Act 1952

DECLARATION IN SUPPORT OF A CONVENTION OR NON-CONVENTION APPLICATION FOR A PATENT OR PATENT OF ADDITION

Name(s) of Applicant(s)

In support of the application made by FARMITALIA CARLO ERBA S.r.l.,

Title

for a patent for an invention entitled SOLUTION SYNTHESIS OF AN OCTAPEPTIDE

Name(s) and address(es) of person(s) making declaration

I/We, Giorgio Orlando Director of Patent and Trademark Department, Farmitalia Carlo Erba S.r.l., Via Carlo Imbonati, 24, 20159, Milan, Italy

do solemnly and sincerely declare as follows:-

1. I am/we are the applicant(s) for the patent, or am/are authorised by the abovementioned applicant to make this declaration on its behalf.

2. The basic application(s) as defined by Section 141 of the Act was/were made in the following country or countries on the following date(s) by the following applicant(s) namely:-

Country, filing date and name of Applicant(s) for the or each basic application

in Great Britain on 7th October 19 87
by Farmitalia Carlo Erba S.r.l.
in _____ on _____ 19 _____
by _____

3. The said basic application(s) was/were the first application(s) made in a Convention country in respect of the invention the subject of the application.

Name(s) and address(es) of the or each actual inventor

4. The actual inventor(s) of the said invention is/are

Roberto de Castiglione, Via Domenichino, 38-Milan, Italy
Mauro Galantino, Via dei Carracci, 8, Milan, Italy
Romualdo Forino, Via del Caravaggio, 14, Milan, Italy

See reverse side of this form for guidance in completing this part

5. The facts upon which the applicant(s) is/are entitled to make this application are as follows:-

The said applicant is the assignee of the said inventors

DECLARED at Milan, Italy this 12th day of September 19 88

(Giorgio Orlando Director of Patent and Trademark Department)

This form may be completed and filed after the filing of a patent application but the form must not be signed until after it has been completely filled in as indicated by the marginal notes. The place and date of signing must be filled in. Company stamps or seals should not be used.

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SOLUTION SYNTHESIS OF AN OCTAPEPTIDE

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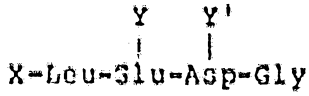
(56) Prior Art Documents
AU 23391/88

(57) Claim

1. A process for preparing a peptide of the formula (A):

H-Leu-Glu-Asp-Gly-Pro-Lys-Phe-Leu-OH (A)

or a pharmaceutically acceptable salt thereof, which process comprises condensing a compound of the formula (B):



X-Leu-Glu-Asp-Gly-Pro-K (B)

wherein X is an amino protecting group, Y and Y' are each optional and each independently represents a carboxy protecting group and K is hydroxy or hydrazido group, with a compound of formula (C)

H-Lys-Phe-Leu-Q (C)

wherein W is an amino protecting group and Q represents a carboxy protecting group or a hydroxy group , deprotecting the resultant compound of the formula (D)

X-Leu-Glu-Asp-Gly-Pro-Lys-Phe-Leu- Q (D)

.../2

wherein X,Y,Y',W and Q are as defined above; and, if desired, converting the resulting peptide of formula (A) into a pharmaceutically acceptable salt thereof.

AUSTRALIA

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Form 10

COMPLETE SPECIFICATION

(ORIGINAL)

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Short Title:

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Lapsed:
Published:

Priority:

Related Art:

TO BE COMPLETED BY APPLICANT

Name of Applicant:
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Australia.

Complete Specification for the invention entitled:
SOLUTION SYNTHESIS OF AN OCTAPEPTIDE

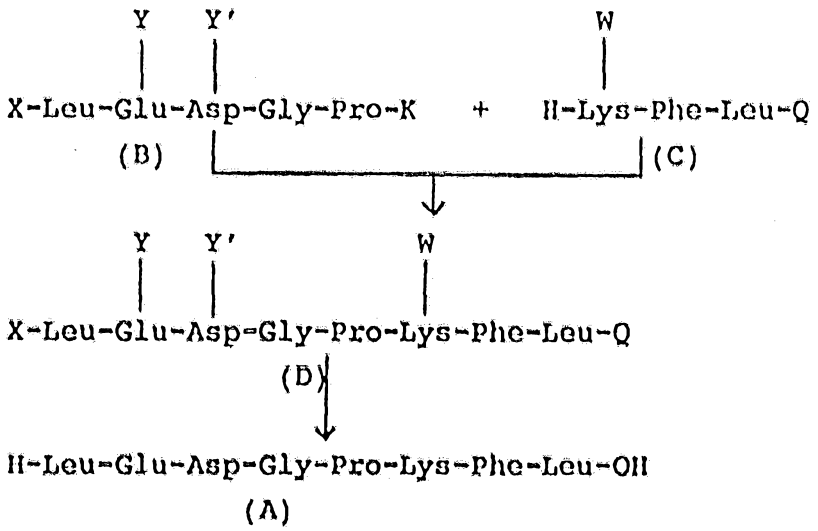
The following statement is a full description of this invention including the best method of performing it known to me:-

SOLUTION SYNTHESIS OF AN OCTAPEPTIDE

The present invention relates to a method for the preparation of the octapeptide of formula H-Leu-Glu-Asp-Gly-Pro-Lys-Phe-Leu-OH (A) and its pharmaceutically acceptable salts. The peptide, having thymic humoral activity was originally isolated from calf thymus glands and then obtained by solid-phase synthesis as described in the U.S. Patent No. 4,621,135.

The present synthesis, based on conventional solution methods, offers the advantage of easier scale-up and better final yields for the purified target product. As a matter of fact, in the process of the present invention there is not formation of succinimidyl derivative, which is the main cyclic byproduct formed in the solid-phase synthesis of the prior art.

The synthetic scheme can be represented as follows;



Wherein:

x and w independently represent amino protecting groups, Q represents a hydroxy group or a carboxy protecting group, K represents a hydroxy or a hydrazido group, and Y and Y' are each optional and each independently represents a carboxy protecting group.

The synthesis of the present invention is characterized by condensation of compounds B and C. The peptides B and C to be condensed and the resultant intermediate D may have their amino and carboxyl groups, which are not involved in the formation of the peptide linkage, blocked by a suitable protecting group. These protecting groups are removable by acidolysis, saponification , hydrogenolysis or other methods according to the methods known in peptide chemistry. The following groups may be used for the protection of the amino functions: benzyloxycarbonyl, t-butyloxycarbonyl, trityl, formyl, trifluoroacetyl, o-nitrophenylsulphenyl, 4-methoxybensyloxycarbonyl, 9-fluorenylmethoxycarbonyl, 3,5-dimethoxy-α,α'dimethylbenzyloxyloxycarbonyl and methyl-sulphonylethoxycarbonyl. The following groups may be used for the protection of the carboxy functions: methyl, ethyl, t-butyl, benzyl, p-nitrobenzyl, 9-fluorenylmethyl, phenyl, 2,2,2-trichloroethyl and substituted hydrazides.
The condensation between the amino group of peptide C and the carboxy group of peptide B to form the intermediate D may be carried out through an activated acyl-derivative such as a mixed anhydride, an azide, an activated ester, an imidazole or substituted imidazole derivative or by direct condensation between the free amino group and the carboxyl group, in the presence of a condensing agent such as dicyclohexyl carbodiimide alone or together with N-hydroxysuccinimide or 1-hydroxybenzotriazole or 1-hydroxy-bensotriazole and 4-dimethylamino-pyridine.
The activated acyl-derivative may be formed "in situ" starting from the compound B wherein K is OH or $NHNH_2$ using known methods. The condensation may be carried out in a solvent such as dimethyl formamide, pyridine, acetonitrile,

tetrahydrofuran, N-methyl-2-pyrrolidone and dimethyl-sulfoxide.

The reaction temperature may be from -30°C to ambient temperature. The reaction time is generally from 1 to 120 hours. Typically both Y and Y' groups are present and comprise the same carboxy protecting group, Q represents a carboxy protecting group and K represents a hydrazido group.

The protecting groups and the condensing agents are selected so as to avoid the risk of racemization. The preparation of starting materials B and C can be accomplished by known classical solution methods. The peptide of formula (A) or pharmaceutically acceptable salt thereof thus produced is recovered. It may be formulated with a pharmaceutically acceptable carrier or diluent to prepare a pharmaceutical composition for administration.

The following Examples illustrate the invention without limiting it. Rf values were determined on pre-coated plates of silica gel 60 F_{254} (Merck), layer thickness 0.25 mm, length 20 cm, using the following development systems:

System A: n-butanol/acetic acid/water = 4/1/1 by volume.
System B: benzene/ethyl acetate/acetic acid/water = 10/10/2/1 by volume (upper phase).
System C: benzene/benzine (60-80)/ethyl acetate = 25/5/70 by volume.
"Merck" is a Trade Mark.

TLC analyses were carried out at a temperature ranging from 18°C to 25°C: the Rf values therefore can change by ± 5%. The Rt values were obtained from HPLC analyses using the following systems:

System 1 - Mobile phase: A (0,02 M KH_2PO_4, pH 3.3, buffer containing 10% v/v acetonitrile); B (0,02 M KH_2PO_4, pH 3.3, buffer containing 60% v/v acetonitrile)
Column. μ BONDAPAK $^{TM}C_{18}$ (WATERS) 10 μm (3.9 mm x 30 cm)
Flow rate: 1 ml/min
U.V. detection: 210 nm.

System 2 - Mobile phase: A (0.02 M KH_2PO_4, pH 3.5, buffer containing 10% v/v acetonitrile); B (0.02 M KH_2PO_4, pH 3.5, buffer containing 70% v/v acetonitrile)
Column: μ BONDAPAK $^{TM}C_{18}$ (WATERS) 10 μm (3.9 mm x 30 cm)
Flow rate: 1 ml/min
U.V. detection: 210 nm.

System 3 - Mobile phase: A (0.02 M KH_2PO_4, pH 3.5, buffer containing 10% v/v acetonitrile); B (0.02 M KH_2PO_4, pH 3.5, buffer containing 70% v/v acetonitrile)
Column: RP-18 5 μm (4 mm x 25 cm) Lichrosorb (Merck)
Flow rate: 1 ml/min
U.V. detection: 210 nm.

System 4 - Mobile phase: A (0.02 M KH_2PO_4, pH 3.3, buffer containing 10% v/v acetonitrile); B (0.02 M KH_2PO_4, pH 3.3, buffer containing 60% v/v acetonitrile)
Column: μ BONDAPAK $^{TM}C_{18}$ (WATERS) 10 μm (3.9 mm X 30 cm)
Flow rate: 1.5 ml/min
U.V. detection: 210 nm

Melting points were determined in open capillaries with a Tottoli apparatus and are uncorrected.
Most of derivatives soften and decompose before melting.
In this specification symbols and abbreviations are those commonly used in peptide chemistry (see, e.g., Eur. J. Biochem., 138, 9-37 (1984)).

Other symbols and abbreviations used in the following Examples are: AcOH, glacial acetic acid; AcOEt, ethyl acetate; dec., decomposition; DMF, dimethyl formamide; ECC, ethyl chloroformate; Et_2O, diethyl ether, EtOH, ethyl alcohol 95%; HPLC, high performance liquid chromatography; i-Pr_2O, diisopropyl ether; i-PrOH, isopropyl alcohol; MEoh, methyl alcohol; NMM, N-methyl morpholine; p-Tos-OH, para-toluensulphonic acid; THF, tetrahydrofuran; TLC, thin layer chromatography, Tce 2,2,2,trichloroethyl, DCC dicyclohexyl carbodiimide, HOBt, 1-hydroxybenzotriazole, DMAP 4-dimethylaminopyridine, DCEU, dicyclohexylurea.

EXAMPLE 1

Preparation of H-Leu-Glu-Asp-Gly-Pro-Lys-Phe-Leu-OH . 2HCl by azide coupling (X = Boc; Y = OBzl --> OH ;K = NH-NH-Z -->N_3; W = Z; Q = OBzl

Step 1 - p-Tos-OH . H-LEU-OBzl (I)

To a suspension of 13.12 g (100 mmoles) of H-Leu-OH in 105 ml of benzyl alcohol and 200 ml of anhydrous chloroform, 38.0 g (200 mmoles) of p-Tos-oh . H_2O were added and the mixture was refluxed for 25 h. The water produced (5.4 ml) was collected using a Dean and Stark separator designed for use with solvents denser than water. Trituration with 500 ml of Et_2O after cooling and evaporation of the chloroform gave 37.46 g (95% yield) of compound I: m.p. 124-126 °C; $[\alpha]_D^{20}$ = -3.0° (C1, MeOH); Rf_A = 0.65; Rt_2 = 16.7 minutes (linear gradient from 10 to 60% B in 20').

Step 2 - Boc-Phe-Leu-OBzl (II)

To a solution of 41.52 g (156,5 mmoles) of Boc-Phe-OH in 240 ml of anhydrous THF, 17.36 ml (156.5 mmoles) of NMM and 15.36 ml (156.5 mmoles) of ECC were successively added at a temperature of -12 °C. After stirring at this temperature for 2 minutes, a cold solution of 61.52 g (156.5 mmoles) of p-Tos-OH . H-Leu-OBzl (I) and 17.36 ml (156.5 mmoles) of NMM in 480 ml of DMF was added. The reaction mixture was stirred for 1 hour at -12 °C, then filtered from salts and evaporated in vacuo. The residue was dissolved in AcOEt and washed several times successively with NaCl saturated solutions of 0,5 M citric acid, 0,5 M $NaHCO_3$ and water. The organic layer was dried over anhydrous Na_2SO_4 and the solvent removed in vacuo.

69 g (94.1% yield) of compound II were obtained from AcOEt/light petroleum: m.p. 84-87 °C; $[\alpha]_D^{20}$ = -22.0° (C 1, MeOH); Rf_B = 0.70; Rt_4 = 11.0 minutes (isocratic 90% B for 15')

Step 3 - HCl . H-Phe-Leu-OBzl (III)

32.0 g (68.3 mmoles) of Boc-Phe-Leu-OBzl (II) were dissolved in 320 ml of a saturated solution of HCl in AcOH. After 30 minutes at room temperature the Boc-removal was complete and the solvent was evaporated in vacuo at 30 °C.

26.0 g (94% yield) of compound III were obtained from AcOEt: m.p. = 158-160 °C; $[\alpha]_D^{20}$ = -17.5° (C 1, MeOH); Rf_A = 0.72; Rt_3 = 13.8 minutes (linear gradient from 60 to 90% B in 20').

Step 4 - Boc-Lys(Z)-Phe-Leu-OBzl (IV)

Starting from 24.37 g (64.1 mmoles) of HCl . H-Phe-Leu-OBzl (III), and operating as in Step 2, 42.01 g (89.7%

yield) of compound IV were obtained from AcOEt/Et_2O: m.p. 120-123 °C; $[\alpha]_D^{20}$ = -28.8° (C 1, MeOH); Rf_B = 0.62; Rt_3 = 21.0 minutes (isocratic 90% B for 30').

Step 5 - HCl . H-Lys(Z)-Phe-Leu-OBzl (V)

Starting from 41.96 g (57.4 mmoles) of Boc-Lys(Z)-Phe-Leu-OBzl (IV) and operating as described in Step 3, 36.82 g (96.1% yield) of compound V were obtained from MeOH/AcOEt: m.p. = 187-191 °C; $[\alpha]_D^{20}$ = -6.3° (C 1, MeOH); Rf_A = 0.61; Rt_3 = 11.0 minutes (isocratic 90% B for 20')

Step 6 - Boc-Pro-NH-NH-Z (VI)

Starting from 21,52 g (100 mmoles) of NH_2-NH-Z, and operating as described in Step 2, 36.3 g (100% yield) of compound VI were obtained as foam: Rf_B = 0.54.

Step 7 - HCl . HPro-NH-NH-Z (VII)

Starting from 36.3 g (100 mmoles) of Boc-Pro-NH-NH-Z (VI) and operating as described in Step 3, 29.5 g (98.4% yield) of compound VII were obtained from AcOEt/Et_2O: m.p. = 70-74 °C; $[\alpha]_D^{20}$ = -26.1°(C 1, MeOH); Rf_A = 0,35; Rt_1 = 9.7 minutes (linear gradient from 10 to 60% B in 20').

Step 8 - Boc-Gly-Pro-NH-NH-Z (VIII)

Starting from 17.2 g (98.08 mmoles) of Boc-Gly-OH and 29.4 g (98.08 mmoles) of HCl . H-Pro-NH-NH-Z (VII), and operating as described in Step 2, 38.6 g (93.6% yield) of compound VIII were obtained from i-Pr_2O: m.p. 70-74

°C; $[\alpha]_D^{20}$ = -86.1° (C 1, MeOH); Rf_B = 0.38; Rt_1 = 21.1 minutes (linear gradient from 30 to 60% B in 30').

Step 9 - HCl . H-Gly-Pro-NH-NH-Z (IX)

Starting from 38.63 g (91.87 mmoles) of Boc-Gly-Pro-NH--NH-Z (VIII) and operating as described in Step 3, 29.2 g (89,1% yield) of compound IX were obtained from AcOEt: m.p. = 216-8 °C; $[\alpha]_D^{20}$ = -78,4°(C 1, MeOH); Rf_A = 0.26; Rt_1 = 10.7 minutes (linear gradient from 10 to 60% B in 30').

Step 10 - Boc-Asp(OBzl)-Gly-Pro-NH-NH-Z (X)

Starting from 26.37 g (81.56 mmoles) of Boc-Asp(OBzl)--OH and 29.1 g (81.56 mmoles) of HCl . H-Gly-Pro-NH-NH--Z (IX), and operating as described in Step 2, 51.0 g (100% yield) of compound X were obtained from AcOEt/i--Pr_2O: m.p. = 70-75 °C; $[\alpha]_D^{20}$ = -72,7°(C 1, MeOH); Rf_B = 0.35; Rt_1 = 16.0 minutes (linear gradient from 60 to 90% B in 20').

Step 11 - HCl . H-Asp(OBzl)-Gly-Pro-NH-NH-Z (XI)

Starting from 51.0 g (81.5 mmoles) of Boc-Asp(OBzl)--Gly-Pro-NH-NH-Z (X), and operating as described in Step 3, 43.3 g (94.6% yield) of compound XI were obtained from AcOEt: m.p. = 105-110 °C; $[\alpha]_D^{20}$ = 60.5°(C 1, MeOH); Rf_A = 0.49; Rt_1 = 15.0 minutes (linear gradient from 30 to 60% B in 25').

Step 12 - Boc-Glu(OBzl)-Asp(OBzl)-Gly-Pro-NH-NH-Z (XII)

Starting from 12.6 g (37.36 mmoles) of Boc-Glu(OBzl)--OH and 21.0 g (37.36 mmoles) of HCl . H-Asp(OBzl)--Gly-Pro-NH-NH-Z (XI), and operating as described in Step 2, 31.5 g (100% yield) of compound XII were obtained from AcOEt/i-Pr_2O: m.p. = 70-75 °C; $[\alpha]_D^{20}$ = -67,7°(C 1, MeOH); Rf_B = 0.35; Rt_3 = 11.6 minutes (linear gradient from 80 to 90% B in 20').

Step 13 - HCl . H-Glu(OBzl)-Asp(OBzl)-Gly-Pro-NH-NH-Z (XIII)

Starting from 31.5 g (37.28 mmoles) of Boc-Glu(OBzl)--Asp(OBzl)-Gly-Pro-NH-NH-Z (XII), and operating as described in Step 3, 27.2 g (93.4% yield) of compound XIII were obtained from THF/Et_2O: m.p. = 103-106 °C; $[\alpha]_D^{20}$ = -56.7° (C 1, MeOH); Rf_A = 0.56; Rt_3 = 6.0 minutes (linear gradient from 80 to 90% B in 15').

Step 14 - Boc-Leu-Glu(OBzl)-Asp(OBzl)-Gly-Pro-NH-NH-Z (XIV)

To a solution of 8.02 g (34.69 mmoles) of Boc-Leu-OH in 60 ml of anydrous THF, 3.85 ml (34.69 mmoles) of NMM and 3.42 ml (34.69 mmoles) of ECC were successively added at a temperature of -12 °C. After stirring at this temperature for 2 minutes, a cold solution of 27.1 g (34.69 mmoles) of HCl . H-Glu(OBzl)-Asp(OBzl)-Gly--Pro-NH-NH-Z (XIII) and 3.85 ml (34.69 mmoles) of NMM in 200 ml of DMF was added.

The reaction mixture was stirred for 1 hour at -12 °C, then filtered from salts, concentrated to small volume and the product precipitated at 0-5 °C by dropping an aqueous solution of citric acid. 31.15 g (92% yield) of

Boc-Leu-Glu(OBzl)-Asp(OBzl)-Gly-Pro-NH-NH-Z (XIV) were obtained from MeOH/i-Pr_2O: m.p. = 107-110 °C; $[\alpha]_D^{20}$ = -67.1°(C 1, MeOH); Rf_B = 0.29; Rt_3 = 17.4 minutes (linear gradient from 80 to 90% B in 15', then isocratic for 10').

Step 15 - Boc-Leu-Glu-Asp-Gly-Pro-NH-NH_2 (XV)

A solution of 28.66 g (29.36 mmoles) of Boc-Leu--Glu(OBzl)-Asp(OBzl)-Gly-Pro-NH-NH-Z (XIV) in 280 ml of dimethyl formamide and 280 ml of methyl alcohol was made to react at room temperature for 30 minutes with 13.05 g of 10% palladium on charcoal, 6,7 ml of formic acid, 10.0 ml of acetic acid and 19,4 ml of N-methylmorpholine. After filtering of the reaction mixture on hyflo supercell, the solvent was evaporated and 18,9 g (100% yield) of Boc-Leu-Glu-Asp-Gly-Pro-NH-NH_2 (XV) were obtained from MeOH/i-Pr_2O: m.p. = 138-143 °C; $[\alpha]_D^{20}$ = -52.7°(C 1, DMF); Rf_A = 0.29; Rt_2 = 8.0 minutes (linear gradient 30 to 70% B for 20').

Step 16 - Boc-Leu-Glu-Asp-Gly-Pro-Lys(Z)-Phe-Leu-OBzl (XVI)

A solution of 25,09 g (38.97 mmoles) of Boc-Leu--Asp-Gly-Pro-NH-NH_2 (XV) in 300 ml of DMF was made to react for 20 minutes at -25 °C with 28,9 ml (120.55 mmoles) of an extemporaneous 4.16 N solution of HCl in THF and 5.01 ml (42.75 mmoles) of n-butylnitrite. After addition of 13.4 ml (120.55 mmoles) of NMM at -40 °C, a cold solution of 27.2 g (40,77 mmoles) of HCl . H-Lys(Z)-Phe-Leu-OBzl (V) and 4.5 ml (40.77 mmoles) of NMM in 300 ml of DMF was poured into. The reaction mixture was stirred for 24 hours at 0 °C, then filtered from salts and concentrated to a small volume. The

product was precipitated by dropwise addition of an aqueous solution of citric acid. 35.3 g (73% yield) of compound XVI were obtained from AcOEt: m.p. = 186-188 °C; $[\alpha]_D^{20}$ = -42.2°(C 1, DMF); Rt_A = 0.78; Rt_2 = 9.5 minutes (linear gradient from 80 to 90% in 20').

Step 17 - Boc-Leu-Glu-Asp-Gly-Pro-Lys-Phe-Leu-OH (XVII)

Starting from 35.2 g (28.33 mmoles) of Boc-Leu-Glu-Asp--Gly-Pro-Lys(Z)-Phe-Leu-OBzl (XVI), and operating as described in Step 15, 28.84 g (100% yield) of compound XVII were obtained from DMF/EtOH 95%/AcOEt: m.p. = 207-210 °C; $[\alpha]_D^{20}$ = -63.5°(C 1, AcOH); Rf_A = 0.30; Rt_2 = 9.2 minutes (linear gradient from 40 to 70% B in 20').

Step 18 - 2HCl . H-Leu-Glu-Asp-Gly-Pro-Lys-Phe-Leu-OH (XVIII)

Starting from 28.8 g (28.28 mmoles) of Boc-Leu-Glu-Asp--Gly-Pro-Lys-Phe-Leu-OH (XVII), and operating as described in Step 3, 28.0 g (100% yield) of compound XVIII were obtained from AcOH/Et_2O: m.p. = 105 °C (softening) - 160 °C (dec.); $[\alpha]_D^{20}$ = -58,4° (C 0.5, MeOH); Rt_2 = 12.0 minutes (linear gradient from 10 to 60% B in 20').

EXAMPLE 2

Preparation of H-Leu-Glu-Asp-Gly-Pro-Lys-Phe-Leu-OH . 2HCl by DCC/HOBt coupling (X = Z; Y Y' = OBzl; K = OTce -->OH; W = Z; Q = OBzl).

Step 1: Z-Leu-Glu(OBzl)-Asp(OBzl)-Gly-Pro-OH (XIX)

A solution of Z-Leu-Glu(OBzl)-Asp(OBzl)-Gly-Pro-OTce in AcOH and water was made to react at room temperature with zinc powder, washed with HCl 0.1 N, acetone and Et_2O. After filtration of the reaction mixture on hyflo supercell, the solvent was evaporated, the residue was dissolved in AcOEt and washed several times successively with NaCl saturated solutions of 0.5M citric acid and water. The organic layer was dried over anhydrous Na_2SO_4, the solvent removed in vacuo, and the compound (XIX) was obtained, Rf_β =0.20.

Step 2: Z-Leu-Glu(OBzl)-Asp(OBzl)-Gly-Pro-Lys(z)-Phe-Leu-OBzl (XX)

A solution of Z-Leu-Glu(OBzl)-Asp(OBzl)-Gly-Pro-OH (XIX) and HCl.H-Lys(Z)-Phe-Leu-OBzl (V) in DMF, were made to react for 4 hours at room temperature with DCC, anhydrous HOBt, DMAP and NMM. The reaction mixture was filtered from DCEU, concentrated to a small volume, and the compound (XX) was obtained, m.p. 179-82°C (dec).

Step 3: H-Leu-Glu-Asp-Gly-Pro-Lys-Phe-Leu-OH (XXX)

A solution of Z-Leu-Glu(OBzl)-Asp(OBzl)-Gly-Pro-Lys(Z)-Phe-Leu-OBzl(XX) in AcOH and MeOH was made to react for 20 minutes at room temperature with 10% palladium on charcoal, formic acid and NMM. (N-methyl-morpholine).

After filtration of the reaction mixture on hyflo supercell, the solvent was evaporated and the compound (XXI) was obtained from EtOH/AcOEt, m.p. 206-210°C (dec.).

Step 4: 2HCl.H-Leu-Glu-Asp-Gly-Pro-Lys-Phe-Leu-OH (XVIII)

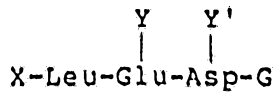
A solution of compound XXI in HCl 1N was evaporated to residue. The title compound (XVIII) was obtained from AcOH/Et_2O.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A process for preparing a peptide of the formula (A):

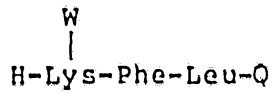
H-Leu-Glu-Asp-Gly-Pro-Lys-Phe-Leu-OH (A)

or a pharmaceutically acceptable salt thereof, which process comprises condensing a compound of the formula (B):



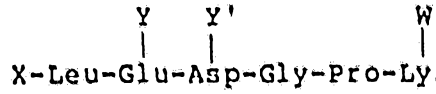
X-Leu-Glu-Asp-Gly-Pro-K (B)

wherein X is an amino protecting group, Y and Y' are each optional and each independently represents a carboxy protecting group and K is hydroxy or hydrazido group, with a compound of formula (C)



H-Lys-Phe-Leu-Q (C)

wherein W is an amino protecting group and Q represents a carboxy protecting group or a hydroxy group ; deprotecting the resultant compound of the formula (D)



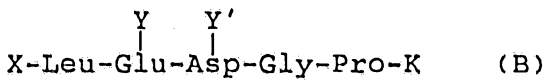
X-Leu-Glu-Asp-Gly-Pro-Lys-Phe-Leu-Q (D)

wherein X,Y,Y',W and Q are as defined above; and, if desired, converting the resulting peptide of formula (A) into a pharmaceutically acceptable salt thereof.

2. A process according to claim 1, wherein both Y and Y' groups are present and comprise the same carboxy protecting group, Q represents a carboxy protecting group and K represents a hydrazido group.

3. A process according to claim 1 or 2, further comprising formulating the peptide of formula (A) or pharmaceutically acceptable salt thereof thus produced with a pharmaceutically acceptable carrier or diluent.

4. The process according to claim 1, wherein a compound of formula (B)

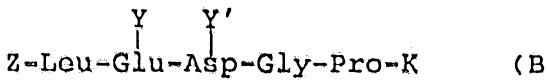


X-Leu-Glu-Asp-Gly-Pro-K (B)

wherein X is Boc, Y and Y' are hydrogen atoms and K is hydrazido group, is obtained by hydrogenolysis of the compound of the formula XIV

Boc-Leu-Glu(OBzl)-Asp(OBzl)-Gly-Pro-NH-NH-Z

5. The process according to claim 1, wherein a compound of formula (B)



Z-Leu-Glu-Asp-Gly-Pro-K (B)

wherein Z is benzyloxycarbonyl, Y and Y' are OBzl and K is hydroxy group, is obtained by treating with zinc powder the compound of the formula

Z-Leu-Glu(OBzl)-Asp(OBzl)-Gly-Pro-OTce.

DATED THIS 3RD DAY OF MAY, 1991
FARMITALIA CARLO ERBA S.r.l.
By Its Patent Attorneys:
GRIFFITH HACK & CO.,
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