Description

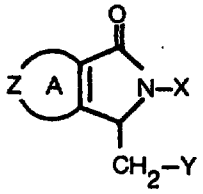
This invention relates to novel condensed pyrrolinone derivatives of value as medicines and their production.

As prior art, reference is made to DE—B—2 141 634, which relates to isoindoline derivatives; DE—B—2 300 491, which relates to pyrrolo[3,4-*b*]pyrazine derivatives; and US—A—4 124 711, which relates to dithiepino[1,4][2,3-C]pyrrole derivatives.

The compounds of these prior art references are tranquilizers and anti-convulsant agents.

Heretofore benzodiazepine compounds have been broadly employed as antianxiety drugs but, because of the drug dependence and side effects such as hypnotic and muscle relaxing effects they produce are not fully satisfactory. The present inventors conducted a series of researches to develop antianxiety drugs in the non-benzodiazepine series and succeeded in the production of compound having very satisfactory properties. This invention has come forth from the above finding and successful production.

This invention provides a compound of the formula (I)

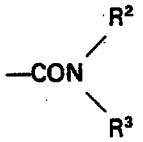


I

wherein

X is aryl, naphthyridinyl, pyridyl or quinolyl, which may optionally be substituted by 1 to 3 of halogen, C_{1-4} alkyl, C_{1-4} alkoxy, methylenedioxy, phenoxy, benzyloxy, hydroxyl, C_{2-5} alkanoyloxy, amino, di-C_{1-4} alkylamino, ω-hydroxy-C_{1-3} alkyl, C_{2-5} alkanoyl, benzoyl, amido, nitro, cyano, trifluoromethyl, C_{1-4} alkylthio, C_{2-5} alkanoyloxy-C_{1-3} alkyl, C_{2-5} alkanoylamino, methoxycarbonyl or ethoxycarbonyl;

Y is the carboxyl group —$COOR^1$ wherein R^1 is C_{1-4} alkyl, phenyl-C_{1-4} alkyl or phenyl, or



wherein R^2 and R^3 are the same or different and each is hydrogen, C_{1-4} alkyl, phenyl-C_{1-4} alkyl, phenyl, thiazolyl or benzothiazolyl, and R^2 and R^3 may each be substituted by halogen, hydroxy, C_{1-4} alkoxy, C_{2-5} alkoxycarbonyl or di-C_{1-4} alkylamino, and

R^2 and R^3 may, together with the adjacent N atom, form a 5- to 7-membered cyclic amino group which may include N, O or S atom as a second hetero-atom, in addition to the said adjacent N atom, and which may have 1 to 2 substituent(s) of hydroxyl, C_{1-4} alkoxy, C_{1-4} alkyl, C_{2-5} alkoxycarbonyl, phenyl-C_{1-4} alkyl, phenyl, piperidino or pyridyl;

Z is —CH=CH—CH=CH—, —S—$(CH_2)_2$—S—, —N=CH—CH=N— or —$(CH_2)_4$—; ring A may be optionally substituted by 1 or 2 substituent(s) of halogen, nitro, amino, C_{2-5} alkanoylamino, C_{2-5} alkoxycarbonyl, carboxyl or carbamoyl; or a salt thereof.

Referring to the above formula (I), ring A may optionally be substituted by one or 2 substituents just mentioned above. Referring to the substituent, halogen includes chlorine, bromine, fluorine and iodine, preferably chlorine; C_{2-5} alkanoylamino includes e.g. acetylamino, propionylamino and butyrylamino; C_{2-5} alkoxycarbonyl includes e.g. methoxycarbonyl, ethoxycarbonyl, and propoxycarbonyl. These substituents may be on any position of the ring A. When Z is —CH=CH—CH=CH—, the substituent(s) preferably is at the 5- and/or 6-position of the ring as isoindolinone. Z is preferably —CH=CH—CH=CH— or —S—$(CH_2)_2$—S—.

The cyclic group X may for example be an aryl (e.g. phenyl or naphthyl), or is pyridyl, quinolyl or naphthyridinyl. Such cyclic group may optionally have 1 to 3 substituents, selected from halogen (e.g. Cl, Br, F, I), C_{1-4} alkyl (e.g. methyl, ethyl, propyl, butyl, isobutyl), C_{1-4} alkoxy (e.g. methoxy, ethoxy, propoxy, isopropoxy), methylenedioxy, phenoxy, benzyloxy, hydroxyl, C_{2-5} alkanoyloxy (e.g. acetoxy, propionyloxy, butyryloxy), amino, di-C_{1-4} alkylamino (e.g. dimethylamino, diethylamino, dipropylamino, dibutylamino), ω-hydroxy-C_{1-3} alkyl (e.g. hydroxymethyl, hydroxyethyl), C_{2-5} alkanoyl (e.g. acetyl, propionyl, butyryl), benzoyl, amido, nitro, cyano, trifluoromethyl, C_{1-4} alkythio (e.g. methylthio, ethylthio, propylthio, butylthio), C_{2-5} alkanoyloxy-C_{1-4} alkyl (e.g. acetyloxyethyl, propionyloxymethyl), C_{2-5} alkanoylamino (e.g. acetylamino, propionylamino), methoxycarbonyl and ethoxycarbonyl.

The above-mentioned cyclic group is preferably unsubstituted or substituted with one halogen atom or C_{1-4} alkoxy group.

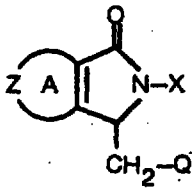
Y may be carboxyl —$COOR^1$ or —$CON\begin{matrix}R^2\\R^3\end{matrix}$

R^1 is a C_{1-4} alkyl group (e.g. methyl, ethyl, propyl, isopropyl, butyl, isobutyl, tert-butyl), a phenyl-C_{1-4} alkyl group (e.g. benzyl) or a phenyl group.

R^2 and R^3 are the same or different and each is hydrogen, a C_{1-4} alkyl group (e.g. methyl, ethyl, propyl, isopropyl), a phenyl-C_{1-4} alkyl (e.g. benzyl, phenethyl, α-methylbenzyl), a phenyl group, a thiazolyl group or a benzothiazolyl group, and these groups may each have substituents selected from halogen (e.g. Cl, Br, F, I), hydroxyl, C_{1-4} alkoxy (e.g. methoxy, ethoxy, propoxy, isopropoxy), C_{2-5} alkoxycarbonyl (e.g. methoxycarbonyl, ethoxycarbonyl) and di-C_{1-4} alkylamino (e.g. dimethylamino, diethylamino).

Moreover, R^2 and R^3 may, together with the adjacent N atom, form a 5- to 7-membered cyclic amino group which may include N, O or S as a second hetero-atom, in addition to the above N atom. Examples of such cyclic amino groups having one N atom are pyrrolidinyl, piperidino and hexahydroazepinyl or those having two N atoms, one N and one S atoms, or one N and one O atoms such as piperazinyl, morpholino and thiazolidinyl. Each of these cyclic amino groups may have 1 to 2 substituents selected from hydroxyl, C_{1-4} alkoxy (e.g. methoxy, ethoxy, propoxy, isopropoxy), C_{1-4} alkyl (e.g. methyl, ethyl, propyl, isopropyl), C_{2-5} alkoxycarbonyl (e.g. methoxycarbonyl, ethoxycarbonyl), phenyl-C_{1-4} alkyl (e.g. benzyl, phenethyl, α-methylbenzyl), phenyl, piperidino and pyridyl.

The compounds of formula (I) of this invention can be produced, for example by hydrolyzing a compound of the formula (II)

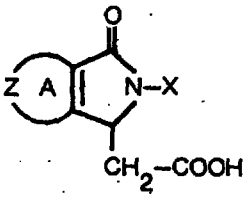


(II)

wherein each symbol is as defined hereinbefore; Q is —$COOR^4$ (R^3 is a lower alkyl group) or —CN, and, if necessary, esterifying or amidating the hydrolysate compound.

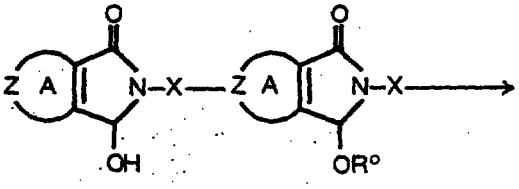
More specifically,

(1) the compound (I) wherein Y is a carboxyl group, i.e. one having the formula:

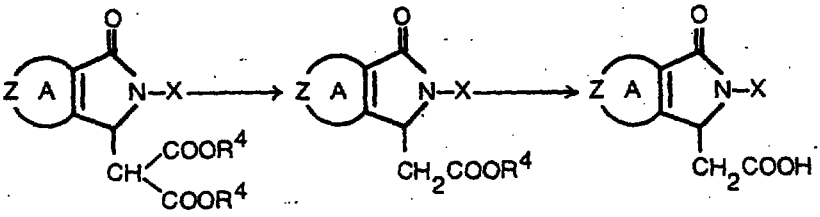


(I–1)

wherein each symbol is as defined hereinbefore, can be produced by the following reactions.



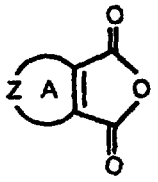
(III) (IV)



(V) (II–a) (I–1)

In the above reaction formulas each symbol is as defined hereinbefore; R° is a lower alkyl group.

The starting compound of general formula (III) can be produced in accordance with the process described in J. Org. Chem. *26*, 2273 (1961) or by the process described in J. Org. Chem. *26*, 2273 (1961) from a compound of general formula (III') which can be prepared by or in general accordance with the processes described in Japanese Patent Publication No. 11940/1973, Japanese Published and Unexamined Patent No. 100495/1977 (Kokai Sho-52-100495), Helv. Chim. Acta *52*, 2228 (1965), J. Hetelocycl. Chem. *7*, 1121 (1970), and Chem. Ber. *40*, 4850 (1907).

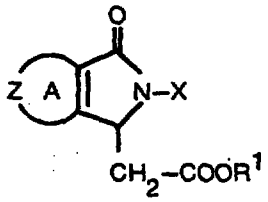


III'

wherein each symbol is as defined hereinbefore.

Thus, a compound of general formula (III) is dissolved in a lower alkanol (R^5OH) and the solution is heated together with a catalyst amount of concentrated hydrochloric acid, whereby the alkyl ether (IV) is easily obtained. The ether compound (IV) can be easily converted to a compound (V) by the reaction of (IV) with a malonic acid diester (e.g. dimethyl malonate, diethyl malonate) under the ordinary conditions of Friedel-Crafts reaction, for example in dichloromethane or dichloroethane solvent in the presence of aluminum chloride. When the compound (V) is heated at 170 to 180°C in dimethyl sulfoxide in the presence of a slight excess of sodium chloride and water, there is produced (II-a). This (II-a) is then hydrolyzed in the presence of a base such as potassium carbonate, sodium hydroxide or potassium hydroxide to give the compound (I—1). This reaction is generally conducted in a solvent such as methanol, ethanol, tetrahydrofuran, dimethylformamide, etc. The reaction is conducted at a temperature of −10°C to +100°C and generally at a temperature between room temperature and the boiling point of the solvent (e.g. methanol).

(2) The compound (I) wherein Y is an esterified carboxyl group, i.e. a compound of formula (I—2)



I–2

wherein R^1 is as defined hereinbefore can be produced by esterifying the carboxylic acid (I—1) obtained in (1) described above or a reactive derivative thereof with an alcohol of the formula (X)

$$R^1OH \qquad X$$

wherein R^1 is as defined hereinbefore.

In the reaction of carboxylic acid (I—1) with alcohol (X), a mixture thereof is heated in the presence of a catalyst to give an ester (I—2). This reaction is generally effected using an excess of alcohol (X) and can be hastened by azeotropic removal of water formed during the reaction. The catalyst may be an inorganic acid such as sulfuric acid, hydrochloric acid, an organic acid or an anhydride thereof such as paratoluenesulfonic acid, trifluoroacetic anhydride, trifluoromethanesulfonic anhydride, or a salt of a heavy metal such as tin, cobalt, iron, aluminum etc. (e.g. $BuSnO_2H$, Bu_2SnO). An alternative process in which (I—1) is reacted with alcohol (X) to give (I—2) is a reaction in the presence of a dehydrating agent such as dicyclohexylcarbodiimide, carbonyldiimidazole, etc. This reaction is generally conducted in pyridine, but any other organic solvent that will not interfere with the reaction can be equally employed. The reaction temperature may range from −20°C to +150°C and, generally, the reaction proceeds satisfactorily at room temperature.

As examples of said reactive derivative of (I—1) there may be mentioned the acid halides (e.g. acid chloride, acid bromide), the acid anhydride obtained by elimination of one molecule of water from 2 molecules of (I—1), and the mixed acid anhydrides obtainable by replacing the carboxyl hydrogen of (I—1) with ethoxycarbonyl, isobutyloxycarbonyl, benzyloxycarbonyl, etc. The reaction of such a reactive derivative with alcohol (X) can be generally conducted in a solvent that does not interfere with the reaction, such as ether, benzene, tetrahydrofuran, dichloromethane, chloroform, dimethylformamide. When necessary, this reaction is conducted in the presence of a base such as pyridine, triethylamine, 4-dimethylaminopyridine, diisopropylethylamine, triethylenediamine, and the reaction temperature is −10° to +100°C and, preferably, 0° to 30°C.

The compound (I—2) can also be produced by reacting an alkali metal salt (e.g. sodium salt) or silver salt of (I—1) with a halide of formula (XI)

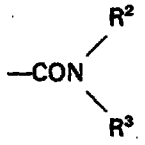
R^1—B XI

wherein R^1 is as defined hereinbefore; B is a halogen atom.

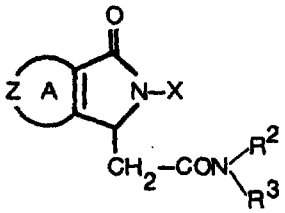
The compound (I—2) wherein R^1 is a tert-butyl group can also be produced by adding (I—1) to isobutylene. This reaction is conducted in the presence of an acid catalyst such as sulfuric acid, boron trifluoride, etc.

Furthermore, in the process of synthesis of (II-a) from compound (IV), by using a corresponding di-lower alkyl ester of malonic acid, there can be produced the corresponding ester (I—2)

(3) The compound (I) wherein Y is

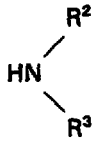


i.e. a compound of formula (I—3)



I—3

wherein each symbol is as defined hereinbefore can be produced by reacting an ester (I—2) or a carboxylic acid (I—1) obtained in (1) or an reactive derivative thereof with an amino compound of formula (XII)



XII

wherein each symbol is as defined hereinbefore.

For producing the compound (I—3) by reacting the ester (I—2) with the amino compound (XII), the reaction is carried out either in a solvent such as toluene, xylene, dichloromethane, chloroform, ethyl acetate, tetrahydrofuran, dimethylformamide or in no solvent. As necessary, the reaction may be conducted in the presence of a base such as pyridine, picoline, triethylamine, 4-dimethylaminopyridine, potassium carbonate, sodium carbonate, an acid such as p-toluenesulfonic acid, methanesulfonic acid, trifluoroacetic acid, or an alkali metal salt such as lithium chloride, sodium chloride, sodium iodide, lithium iodide, lithium bromide, sodium bromide. The reaction is normally carried out at a temperature of 0°—260°C, and preferably 60° to 130°C.

The reactive derivative of the carboxyl group of said compound (I—1) includes, in addition to those employed in the above-mentioned process (2), such other derivatives as N-hydroxydiacylimide esters (e.g. N-hydroxysuccinimide ester, N-hydroxyphthalimide ester, N-hydroxy-5-norbornene-2,3-dicarboximide ester), for instance. This reaction is generally conducted in a solvent such as dichloromethane, tetrahydrofuran, chloroform, dimethylformamide, acetonitrile. These solvents are mentioned only as examples and any other solvent that does not interfere with the reaction can be successfully employed. If necessary, this reaction can be conducted in the presence of a base such as pyridine, triethylamine, 4-dimethylaminopyridine, diisopropylethylamine, triethylenediamine, potassium carbonate, sodium hydroxide. The reaction temperature is generally −10°C to +100°C, and preferably 0°C to 30°C. When (I—1) as such, instead of a reactive derivative thereof, is employed, the reaction is conducted in the presence of a dehydrating agent such as a dicyclohexylcarbodiimide, carbonyldiimidazole, diethyl phosphorocyanidate, diphenylphosphoryl azide. The reaction may also be conducted in the presence of a base such as pyridine, picoline, triethylamine, sodium hydroxide, potassium carbonate. The reaction is generally conducted at a temperature of −20°C to +150°C. In most instances, the reaction proceeds satisfactorily at room temperature.

Moreover, the compound (I) can also be produced in one step by reacting said compound (III) with a compound of formula (XIII)

$Ph_3P{=}CHY$ XIII

wherein Y is as defined hereinbefore.

This reaction is conducted in an organic solvent such as toluene, ethyl acetate, methoxyethane.

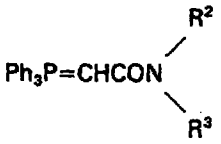
Aside from these solvents, any other organic solvent that does not interfere with the reaction can also be employed. The reaction temperature is generally 10°C to 120°C. When Y is an esterified carboxyl group (I—2), the amide (I—3) can be produced by the treatment of the ester (I—2) with the amine (XII) described above under the noted reaction conditions. If necessary, it is first hydrolyzed to the free carboxyl group. It is then converted to a reactive derivative such as an acid chloride or a mixed acid anhydride and reacted with the amine mentioned above. Or the above carboxylic acid is reacted with the amine in the presence of an acid activator such as carbonylimidazole or diethyl phosphorocyanidate to give a compound (I—3) wherein Y is an amidated carboxyl group.

Among the above-mentioned compounds (XIII), the compound of formula (XIII—2)

$$Ph_3P{=}CHCOOR^1 \qquad \text{XIII—2}$$

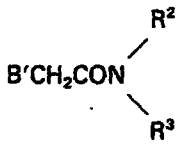
wherein R^1 is as defined hereinbefore, is a known compound and can be prepared for example by the process described in Helv. Chim. Acta. *44*, 1242 (1957).

The compound of formula (XIII—3)



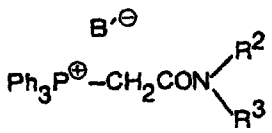
XIII—3

wherein R^2 and R^3 are as defined hereinbefore, is a novel compound and can be produced for example by the steps of treating an α-haloacetamide compound of formula (XIV)



XIV

wherein B' is a halogen atom; and R^2 and R^3 are as defined hereinbefore and triphenylphosphine in the known manner, for example by heating them together at 10 to 120°C in toluene, benzene, ethyl acetate, acetonitrile, dimethylformamide or the like and treating the resulting phosphonium salt (XV)



XV

wherein B', R^2 and R^3 are as defined hereinbefore in the known manner, for example by reacting (XV) with an alkali, e.g. sodium hydroxide or potassium hydroxide, in aqueous solution at 0 to 50°C.

The compounds (I) of this invention which can be produced by the above-described reactions, i.e. compounds (I—1), (I—2) and (I—3), can each be isolated from the reaction mixture by separation and purification procedures known per se (e.g. extraction, recrystallization, column chromatography).

The compound (I—1) wherein Y is a free carboxyl group can be isolated in the form of a salt, for example as a metal salt such as the sodium, potassium or calcium salt. When the compound (I) of this invention is basic, it can be isolated in the form of a salt with an acid, examples of which are pharmaceutically acceptable salts such as salts with inorganic acids (e.g. hydrochloride, nitrate, phosphate, hydrobromide) or salts with organic acids (e.g. acetate, fumarate, maleate, oxalate, tartarate, methanesulfonate, etc.).

There are optical isomers for compounds of this invention and such isomers as well as racemes are also within the scope of this invention. In each of the above-mentioned processes, (I) is generally produced in racemic form but can be resolved into two optically active compounds by the conventional optical resolution procedure, if desired.

The compound (I) according to this invention, particularly the compound (I—3), acts on the central nervous system to display a strong antianxiety effect as demonstrated by anticonflict tests in rats. The minimal lethal dose (MLD) of the compound of this invention is at least 500 mg/kg in mice and the minimal effective dose (MED) is not more than 2.5 mg/kg in rats. Since the safety margin of the compound is very large and its hypnotic and muscle relaxing effects as side effects are very weak as compared with the benzodiazepine antianxiety drugs currently on the market, it can be administered safely and effectively as an antianxiety drug to mammalian animals including human beings. The indications of this compound may include various psychosomatic diseases such as autonomic imbalance, nervous vomiting, neurodermatitis,

alopecia areata, nervous angina, nervous dyspnea, etc. as well as anxiety neurosis, and the compound (I) can be used for the prevention or treatment of such diseases. Furthermore, this compound has anticonvulsant activity and, therefore, can be used in cases of epilepsy, traumatic convulsion, etc. The compound according to this invention can be administered orally or otherwise to mammalian animals including man, in various dosage forms such as tablets, granules, capsules, injections, suppositories, etc. While the dosage depends on the disease, condition, etc., the compound is administered generally in the daily dose of 0.001 to 50 mg per kg body weight in the case of animals and in the daily dose of 0.1 to 100 mg, or preferably 0.5 to 20 mg, in the case of an adult human.

Furthermore, as is apparent from the foregoing description of production processes, the compounds (I—1) and (I—2) according to this invention are of use as intermediates for the production of (I—3).

The reference and working examples of this invention set forth hereinafter are further illustrative of this invention.

Test Example

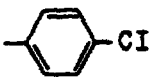
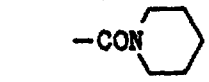
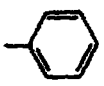
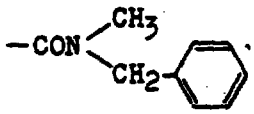
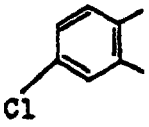
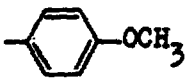
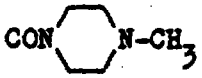
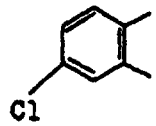
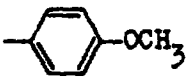
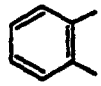
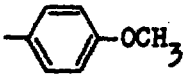
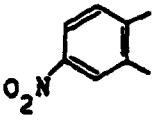
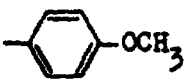
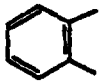
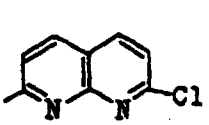
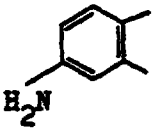
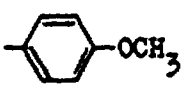
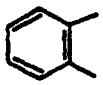
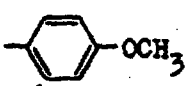
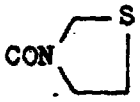
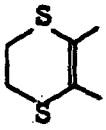
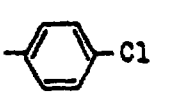
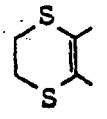
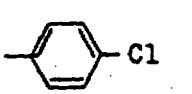
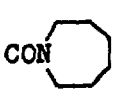
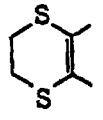
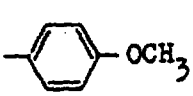
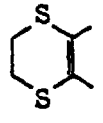
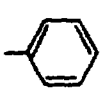
The pharmacological properties of the compounds (I) of this invention were investigated by determining the substituting power thereof for radioactive diazepam from a benzodiazepine receptor.

(Method)

Specific benzodiazepine receptor binding was carried out according to the method of C. Braestrup and R. F. Squiras (European J. Pharmacol., Vol. 48, 263—270, 1978). Thus, crude mitochondrial fractions obtained from the cerebral cortex of male SD strain rats 9 to 10 weeks of age were suspended in 50 mM Tris-HCl buffer (pH 7.4) and incubated with one of a series of concentrations of the test compound and (^{3}H) diazepam (final concentration 2 nM) at 4°C for 20 minutes. Then, the suspension was filtered through a Whatman GF/B glass fiber filter and the radioactivity of (^{3}H) diazepam on the filter was measured by the liquid scintillation method. The concentration of the test drug which caused a 50% inhibition of (^{3}H) diazepam specific binding was taken as the IC_{50} value. The results are summarised in Table 1.

Table 1

Effect on specific binding of (^{3}H) diazepam

Compound (I) A ring	X	Y	IC_{50} (nM)
			8.86
			19.50
			1.99
			0.794
			4.46
			2.40
			0.645
			3.80
			4.90
			9.55
			5.75
			1.05
			7.58

Example 1

3-Oxo-2-phenylisoindoline-1-acetic acid

(a) Concentrated hydrochloric acid (1 ml) was added to a solution of 27 g of 3-hydroxy-2-phenylisoindolin-1-one in 300 ml of methanol and the mixture was refluxed for 1.5 hours. Then, 200 ml of the methanol was distilled off under reduced pressure and 500 ml of a saturated sodium hydrogen carbonate solution was added, followed by extraction with ethyl acetate. The extract was washed with water and dried, and the solvent was distilled off to give 28 g of crystals of 3-methoxy-2-phenylisoindolin-1-one, which, after recrystallization from ethyl acetate, melted at 83—84°C.

Elemental analysis:

Calcd. for $C_{15}H_{13}NO_2$:	C, 75.30;	H, 5.48;	N, 5.85
Found:	C, 75.57;	H, 5.33;	N, 5.93

(b) A solution of 8.3 g of the above product and 6.7 g of diethyl malonate in 50 ml of dichloroethane was added dropwise to a suspension of 7.5 g of aluminum chloride in 80 ml of dichloroethane with stirring at room temperature. After completion of addition, the mixture was refluxed for 40 minutes and then cooled. Then, 300 ml of 6 N hydrochloric acid was added and the mixture was stirred at room temperature for an hour, followed by addition of 150 ml of dichloroethane. The resulting mixture was shaken well and the organic layer was separated, washed with water, aqueous sodium hydrogen carbonate and water in that order, and dried. The solvent was then distilled off to give 10.5 g of ethyl 3-oxo-2-phenylisoindoline-1-malonate as an oil.

(c) The above product (10.5 g) was dissolved in 20 ml of dimethyl sulfoxide, to the solution 0.51 g of water and 1.7 g of sodium chloride were added, and the mixture was stirred with heating at 170°C—180°C for 3 hours. After cooling, the reaction mixture was poured into 500 ml of ice water and extracted with 400 ml of a 1:1 ethyl acetate-ether mixture. After washing and dehydration, the solvent was distilled off. The crystalline residue was washed with hexane and collected by filtration to give 5.6 g of ethyl-3-oxo-2-phenylisoindoline-1-acetate, which was purified by recrystallization from ether, melted at 109°C—110°C.

Elemental analysis:

Calcd. for $C_{18}H_{17}NO_3$:	C, 73.20;	H, 5.80;	N, 4.74
Found:	C, 72.89;	H, 5.61;	N, 4.79

(d) The above crystals (5 g) were dissolved in 50 ml of methanol, to the solution 15 ml of a 15% aqueous solution of potassium carbonate was added, and the mixture was refluxed for 1.5 hours. The methanol was distilled off under reduced pressure, followed by addition of 100 ml of water and 100 ml of ether. The mixture was shaken, and the aqueous layer was separated and acidified with concentrated hydrochloric acid. The crystalline precipitate was collected by filtration and dried. Recrystallization from methanol-ethyl acetate gave the title compound melting at 204—205°C.

Yield: 3.8 g.

Elemental analysis:

Calcd. for $C_{16}H_{13}NO_3$:	C, 71.90;	H, 4.90;	N, 5.24
Found:	C, 72.07;	H, 5.00;	N, 5.30

Example 2

The following 3-oxo-2-(substituted-phenyl)isoindoline-1-acetic acids were produced from the corresponding 3-hydroxy-2-(substituted-phenyl)isoindolin-1-ones in a manner similar to that of Example 1:

i) 3-Oxo-2-(2-chlorophenyl)isoindoline-1-acetic acid

M.p. 163—165°C

Elemental analysis:

Calcd. for $C_{16}H_{12}NO_3Cl$:	C, 63.82;	H, 4.00;	N, 4.64
Found:	C, 63.79;	H, 4.12;	N, 4.77

ii) 3-Oxo-2-(3-chlorophenyl)isoindoline-1-acetic acid

M.P. 157—160°C

Elemental analysis:

Calcd. for $C_{16}H_{12}NO_3Cl$:	C, 63.69;	H, 4.00;	N, 4.64
Found:	C, 63.82;	H, 4.04;	N, 4.46

iii) 3-Oxo-2-(4-chlorophenyl)isoindoline-1-acetic acid

M.P. 204—205°C

Elemental analysis:

Calcd. for $C_{16}H_{12}NO_3Cl$:	C, 63.69;	H, 4.00;	N, 4.64
Found:	C, 63.74;	H, 3.97;	N, 4.16

iv) 3-Oxo-2-(4-methoxyphenyl)isoindoline-1-acetic acid
M.P. 222—223°C
Elemental analysis:
Calcd. for $C_{17}H_{15}NO_4$: C, 68.67; H, 5.08; N, 4.71
Found: C, 68.49; H, 4.90; N, 4.69

v) 3-Oxo-2-(5-chloro-2-pyridyl)isoindoline-1-acetic acid
M.P. 159—160°C
Elemental analysis:
Calcd. for $C_{15}H_{11}N_2O_3Cl$: C, 59.51; H, 3.66; N, 9.25
Found: C, 59.76; H, 3.66; N, 9.11

Example 3

2-Phenyl-3-piperidinocarbonylmethylisoindolin-1-one

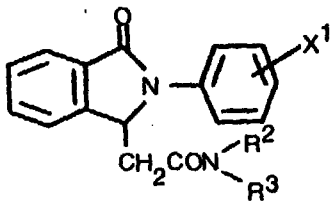
A mixture of 1.8 g of 3-oxo-2-phenylisoindoline-1-acetic acid and 7 ml of thionyl chloride was heated at 70°C for 10 minutes and the excess thionyl chloride was distilled off under reduced pressure to give the corresponding acid chloride. Triethylamine (1 ml) was added to a solution of 0.62 g of piperidine in 30 ml of methylene chloride and to this solution the above-mentioned acid chloride was added portionwise with stirring at room temperature. The mixture was further stirred at room temperature for 30 minutes, 100 ml of methylene chloride was added, and the whole mixture was washed with water. After drying, the solvent was distilled off to give 1.8 g of crystals, which were recrystallized from ethyl acetate.

M.P. 122—123°C, 134—136°C (double melting point)
Elemental analysis:
Calcd. for $C_{21}H_{22}N_2O_2$: C, 75.42; H, 6.63; N, 8.38
Found: C, 75.42; H, 6.44; N, 8.25

Example 4

In the same manner as Example 3, there were obtained the compounds listed in Table 2.

TABLE 2



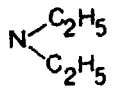
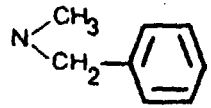
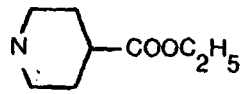
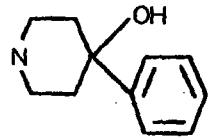
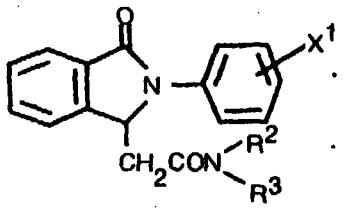
No.	X^1	$N\begin{smallmatrix}R^2\\R^3\end{smallmatrix}$	M.p. (°C)	molecular formula	Elemental analysis Calcd. (Found)		
					C	H	N
1	H		89~90	$C_{20}H_{22}N_2O_2$	74.51 (74.45)	6.88 (6.94)	8.69 (8.78)
2	H		110~118	$C_{24}H_{22}N_2O_2$	77.81 (77.95)	5.99 (6.00)	7.56 (7.34)
3	H		199~200	$C_{20}H_{20}N_2O_2$	74.97 (74.79)	6.29 (6.02)	8.74 (8.64)
4	H		122~123, * 134~136	$C_{21}H_{22}N_2O_2$	75.42 (75.42)	6.63 (6.44)	8.38 (8.25)
5	H		134~135	$C_{22}H_{24}N_2O_2$	75.83 (75.93)	6.94 (6.67)	8.04 (7.96)
6	H		104~105	$C_{24}H_{26}N_2O_4$	70.91 (71.03)	6.45 (6.55)	6.89 (6.99)
7	H		221~223	$C_{27}H_{26}N_2O_3$	76.03 (75.71)	6.15 (6.18)	6.57 (6.27)

TABLE 2 (continued)



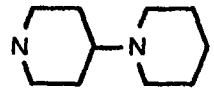
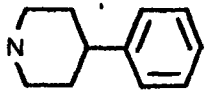
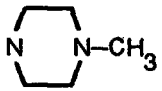
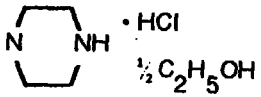
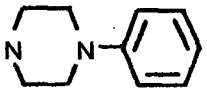
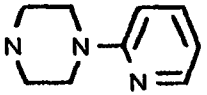
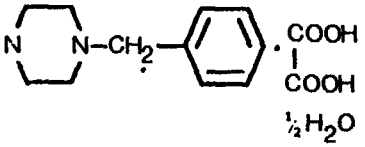
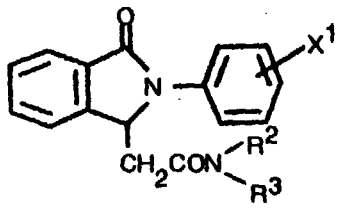
No.	X^1	$N(R^2)(R^3)$	M.p. (°C)	molecular formula	Elemental analysis Calcd. (Found)		
					C	H	N
8	H		145~148	$C_{26}H_{31}N_3O_2$	74.79 (74.94)	7.48 (7.33)	10.06 (10.04)
9	H		200~201	$C_{27}H_{26}N_2O_2$	79.00 (79.01)	6.38 (6.39)	6.83 (6.74)
10	H		136~161	$C_{21}H_{23}N_3O_2$	72.18 (72.17)	6.63 (6.55)	12.03 (11.82)
11	H		238~244	$C_{20}H_{21}N_3O_2 \cdot HCl \cdot \frac{1}{2}C_2H_6O$	63.87 (63.73)	6.38 (6.03)	10.64 (10.93)
12	H		168~190	$C_{26}H_{25}N_3O_2$	75.89 (75.82)	6.12 (6.29)	10.21 (9.94)
13	H		192~206	$C_{25}H_{24}N_4O_2$	72.79 (72.63)	5.87 (6.10)	13.58 (13.50)
14	H		207~210	$C_{27}H_{27}N_3O_2 \cdot C_2H_2O_4 \cdot \frac{1}{2}H_2O$	66.40 (66.26)	5.76 (5.63)	8.01 (8.17)

TABLE 2 (continued)



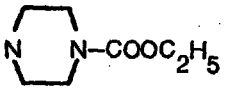
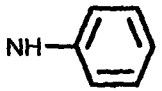
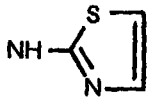
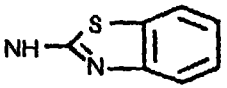
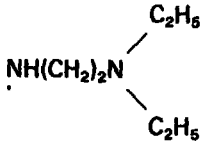
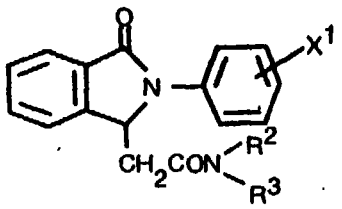
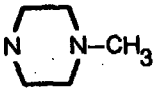
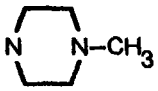
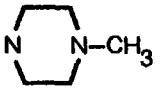
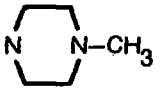
No.	X¹	$N\langle^{R^2}_{R^3}$	M.p. (°C)	molecular formula	Elemental analysis Calcd. (Found) C	H	N
15	H		85~93	$C_{23}H_{25}N_3O_4$	67.79 (68.00)	6.18 (6.08)	10.31 (10.22)
16	H		144~146	$C_{20}H_{20}N_2O_3$	71.41 (71.49)	5.99 (5.83)	8.33 (7.95)
17	H		177~178	$C_{22}H_{18}H_2O_2$	77.17 (77.40)	5.30 (5.37)	8.18 (8.22)
18	H		139~140	$C_{20}H_{20}N_2O_4$	68.17 (67.85)	5.72 (6.12)	7.95 (7.77)
19	H		247~248	$C_{19}H_{15}N_3O_2S$	65.31 (65.39)	4.33 (4.21)	12.03 (11.96)
20	H		265.5~267.5	$C_{23}H_{17}N_3O_2S$	69.15 (69.32)	4.29 (4.24)	10.52 (10.46)
21	H		oil	$C_{22}H_{27}N_3O_2$	72.30 (70.51)	7.45 (7.49)	11.50 (11.32)
22	o-Cl		139~140	$C_{21}H_{21}N_2O_2Cl$	68.38 (68.41)	5.73 (5.57)	7.59 (7.38)

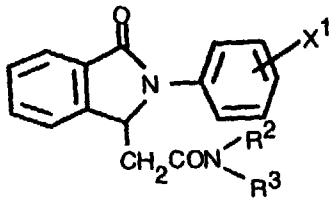
TABLE 2 (continued)

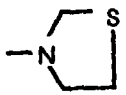
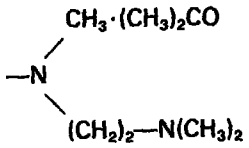
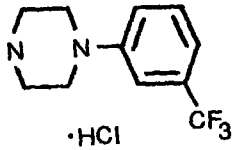


No.	X^1	$N(R^2)(R^3)$	M.p. (°C)	molecular formula	Elemental analysis Calcd. (Found)		
					C	H	N
23	o-Cl		132~134	$C_{21}H_{22}N_3O_2Cl$	65.70 (65.57)	5.77 (5.76)	10.95 (10.61)
24	m-Cl		123~124	$C_{21}H_{21}N_2O_2Cl$	68.38 (68.13)	5.73 (5.53)	7.59 (7.34)
25	m-Cl		126~127	$C_{21}H_{22}N_3O_2Cl$	65.70 (65.80)	5.77 (5.60)	10.95 (10.89)
26	p-Cl		128~129	$C_{21}H_{21}N_2O_2Cl$	68.88 (68.58)	5.73 (5.76)	7.59 (7.42)
27	p-Cl		154~155	$C_{21}H_{22}N_3O_2Cl$	65.70 (65.47)	5.77 (5.79)	10.95 (10.60)
28	p-OCH_3		86~88	$C_{22}H_{24}N_2O_3$	72.50 (72.54)	6.64 (6.79)	7.69 (8.00)
29	p-OCH_3		138~140	$C_{22}H_{25}N_3O_3$	69.63 (69.59)	6.64 (6.68)	11.08 (11.10)

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TABLE 2 (continued)



No.	X^1	$N(R^2)(R^3)$	M.p. (°C)	molecular formula	Elemental analysis Calcd. (Found)		
					C	H	N
30	H		175~176	$C_{19}H_{18}N_2O_2S$	67.43 (67.39)	5.36 (5.35)	8.28 (8.08)
31	H		48~62	$C_{21}H_{25}N_3O_2 \cdot (CH_3)_2CO$	70.39 (70.55)	7.63 (7.54)	10.26 (10.10)
32	H		102~135	$C_{27}H_{24}F_3N_3O_2 \cdot HCl$	62.85 (62.88)	4.88 (4.94)	8.14 (8.12)

* double melting point

Example 5

3-(4-Benzylpiperazin-1-yl)carbonylmethyl-2-phenylisoindolin-1-one oxalate

An oily product (4.3 g), which was prepared from 2.67 g of 3-oxo-2-phenylisoindoline-1-acetic acid and 1.94 g of 1-benzylpiperazine in the same manner as Example 3, was dissolved in 4 ml of methanol, and to this solution a solution of 1.5 g of oxalic acid dihydrate in 6 ml of methanol was added, and the crystals precipitated were collected by filtration. Yield, 4.90 g; m.p., 207—210°C (recrystallization from methanol).

Elemental analysis:

Calcd. for $C_{27}H_{27}N_3O_2 \cdot C_2H_2O_4 \cdot 1/2H_2O$: C, 66.40; H, 5.76; N, 8.01
Found: C, 66.26; H, 5.63; N, 8.17

Example 6

3-Piperidinocarbonylmethyl-2-(5-chloro-2-pyridyl)isoindolin-1-one

3-Oxo-2-(5-chloro-2-pyridyl)isoindoline-1-acetic acid (1 g) and triethylamine (0.8 g) were dissolved in 20 ml of dry tetrahydrofuran and, under ice-cooling with stirring, 0.39 g of ethoxycarbonyl chloride was added portionwise. The mixture was stirred for 30 minutes, 0.56 g of piperidine was added, and the whole mixture was stirred for an additional 30 minutes. The reaction mixture was poured into 500 ml of ice water, followed by extraction with ethyl acetate. The extract was washed with water and dried. The ethyl acetate was then distilled off and the residue was treated with ether. The resulting crystals thus obtained were collected by filtration and recrystallized from ethyl acetate to give 0.32 g of colorless crystals, melted at 165—166°C.

Example 7

Following the procedure of Example 6 except that 4-methylpiperazine was used in lieu of piperidine, there was obtained 3-(4-methylpiperazin-1-yl)carbonylmethyl-2-(5-chloro-2-pyridyl)isoindolin-1-one. M.p. 190—193°C.

Example 8

Methyl 3-oxo-2-(5-chloro-2-pyridyl)isoindoline-1-acetate

To 1 g of 3-oxo-2-(5-chloro-2-pyridyl)isoindoline-1-acetic acid was added 20 ml of 10% methanolic hydrochloric acid and the mixture was refluxed. After 5 hours, the reaction mixture was concentrated under reduced pressure, 100 ml of aqueous sodium hydrogen carbonate solution was added to the residue and the mixture was extracted with ethyl acetate. The extract was washed with water, dried and concentrated to give about 1 g of crystals, which were recrystallized from ethyl acetate-ether. M.p. 110—111°C.

Elemental analysis:

Calcd. for $C_{16}H_{13}N_2O_3Cl$: C, 60.67; H, 4.13; N, 8.84
Found: C, 60.50; H, 4.13; N, 8.78

Example 9

In the same manner as Example 8, there was obtained the following compound:

(i) Methyl 3-oxo-2-(4-methoxyphenyl)isoindoline-1-acetate

M.p. 80°C

Elemental analysis:

Calcd. for $C_{18}H_{17}NO_4$: C, 69.44; H, 5.50; N, 4.50
Found: C, 69.56; H, 5.07; N, 5.62

Example 10

In the same manner as (a)-(c) of Example 1, there were obtained the following compounds:

(i) Ethyl 3-oxo-2-(3-chlorophenyl)isoindoline-1-acetate

M.p. 82—83°C

Elemental analysis:

Calcd. for $C_{18}H_{16}NO_3Cl$: C, 65.55; H, 4.89; N, 4.24
Found: C, 65.51; H, 4.73; N, 4.11

(ii) Ethyl 3-oxo-2(4-chlorophenyl)isoindoline-1-acetate

M.p. 55—56°C

Elemental analysis:

Calcd. for $C_{18}H_{16}NO_3Cl$: C, 65.55; H, 4.89; N, 4.24
Found: C, 65.27; H, 4.64; N, 4.00

Example 11

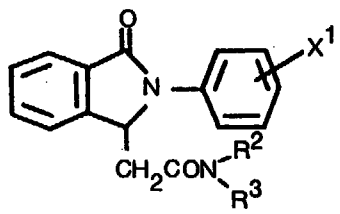
3-Hydroxy-2-(3,4,5-trimethoxyphenyl)isoindolin-1-one (1.1 g) and piperidinocarbonylmethylene-triphenylphosphorane (1.8 g) were dissolved in 20 ml of toluene and the solution was refluxed for 2 hours. After cooling, the toluene was distilled off and ether was added to the residue to give crude crystals, which were recrystallized from ether giving 1.0 g of 2-(3,4,5-trimethoxyphenyl)-3-piperidinocarbonylmethylisoindolin-1-one.

M.p. 84—86°C
Elemental analysis:
Calcd. for $C_{24}H_{28}N_2O_5$: C, 67.90; H, 6.65; N, 6.60
Found: C, 67.88; H, 6.66; N, 6.56

Example 12

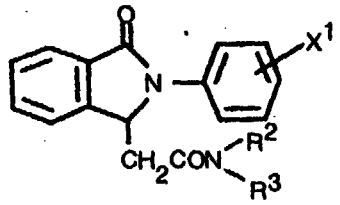
In the same manner as Example 11, there were obtained the compounds listed in Table 3.

TABLE 3



No.	X^1	$N\begin{smallmatrix}R^2\\R^3\end{smallmatrix}$	M.p. (°C)	molecular formula	Elemental analysis Calcd. (Found)		
					C	H	N
1	p-OCH_3		119~120	$C_{23}H_{26}N_2O_3$	72.99 (73.23)	6.93 (6.98)	7.40 (7.28)
2	p-OCH_3		139~140	$C_{20}H_{20}N_2O_3S$	65.20 (65.16)	5.47 (5.45)	7.60 (7.46)
3	p-NO_2		168~176	$C_{21}H_{21}N_3O_4$	66.48 (66.10)	5.58 (5.54)	11.07 (10.90)
4	p-OH		216~220	$C_{21}H_{22}N_2O_3$	71.98 (71.80)	6.33 (6.25)	7.99 (7.58)
5	p-$CO_2C_2H_5$		144~145	$C_{23}H_{24}N_2O_4$	70.39 (70.30)	6.16 (6.07)	7.14 (7.05)
6	p-$NH_2 \cdot HCl$		176~186	$C_{21}H_{23}N_3O_2 \cdot HCl$	65.36 (65.39)	6.27 (6.24)	10.89 (10.81)
7	p-$NHCOCH_3$		183~185	$C_{23}H_{25}N_3O_3$	70.57 (70.41)	6.44 (6.44)	10.73 (10.68)
8	p-OC_2H_5		118~120	$C_{23}H_{26}N_2O_3$	72.99 (72.77)	6.92 (6.86)	7.40 (7.25)

TABLE 3 (continued)



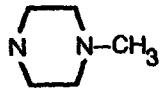
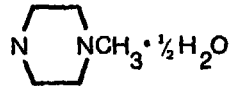
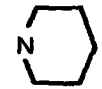
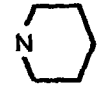
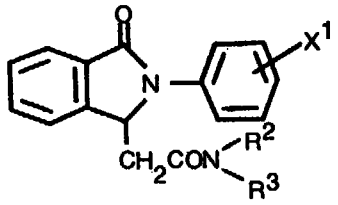
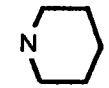
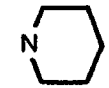
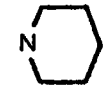
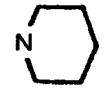
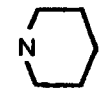
No.	X'	$N\langle^{R^2}_{R^3}$	M.p. (°C)	molecular formula	Elemental analysis Calcd. (Found) C	H	N
9	p-OCH_2Ph		171~173	$C_{28}H_{28}N_2O_3$	76.34 (76.61)	6.41 (6.46)	6.36 (6.18)
10	p-NO_2		208~210	$C_{21}H_{22}N_4O_4$	63.95 (63.73)	5.62 (5.71)	14.20 (14.14)
11	p-CH_3		142~144	$C_{22}H_{24}N_2O_2$	75.83 (75.87)	6.94 (7.03)	8.04 (8.22)
12	p-CO_2H		198~199	$C_{22}H_{22}N_2O_4$	69.82 (69.64)	5.86 (5.94)	7.40 (7.25)
13	p-O-n-C_4H_9		59~62) * 64~66)	$C_{25}H_{30}N_2O_3$	73.86 (74.14)	7.44 (7.61)	6.89 (6.95)
14	p-CH_3		160~161	$C_{22}H_{25}N_3O_2 \cdot \frac{1}{2}H_2O$	70.94 (71.19)	7.04 (6.60)	11.28 (11.28)
15	p-OH		205~207	$C_{22}H_{24}N_2O_3$	72.51 (72.76)	6.64 (6.44)	7.69 (7.95)
16	p-F		113~114.5	$C_{21}H_{21}FN_2O_3$	71.57 (71.81)	6.01 (5.84)	7.95 (8.18)
17	p-$(CH_2)_2$—OH		153~155	$C_{23}H_{26}N_2O_3$	72.99 (72.72)	6.98 (6.86)	7.40 (7.43)

TABLE 3 (continued)



No.	X^1	$N(R^2)(R^3)$	M.p. (°C)	molecular formula	Elemental analysis Calcd. (Found)		
					C	H	N
18	m-CF_3		108~110	$C_{22}H_{21}F_3N_2O_2$	65.66 (65.54)	5.26 (5.55)	6.96 (6.87)
19	3.4-diOCH_3		119~120	$C_{23}H_{26}N_2O_4$	70.03 (69.73)	6.64 (6.78)	7.10 (7.09)
20	3.5-diOCH_3		122~123	$C_{23}H_{26}N_2O_4$	70.03 (69.98)	6.64 (6.49)	7.10 (7.15)
21	2.5-diOCH_3		oil	$C_{23}H_{26}N_2O_4$	70.03 (69.89)	6.64 (6.61)	7.10 (7.12)
22	4-$CONH_2$		210~211	$C_{22}H_{23}N_3O_3$	70.01 (69.69)	6.14 (6.05)	11.13 (11.23)

* double melting point

Example 13

i) A solution of 3-hydroxy-2-(4-methoxyphenyl)isoindolin-1-one (12.0 g) and ethoxycarbonylmethylenetriphenylphosphorane (16.0 g) in toluene (200 ml) was refluxed for 3 hours. After cooling, the toluene was distilled off and the residue was dissolved in 100 ml of methanol. A solution of 10 g of potassium carbonate in 70 ml of water was added to the above methanol solution and the mixture was refluxed gently for an hour. After cooling, 200 ml of water and 300 ml of ether were added and the mixture was shaken well. The aqueous layer was separated and acidified with 5 N hydrochloric acid to give 12 g of 3-oxo-2-(4-methoxyphenyl)isoindoline-1-acetic acid, which was described in iv) of Example 2.

ii) The above acetic acid derivative (6.53 g) was dissolved in 30 ml of thionyl chloride and the solution was refluxed gently for 10 minutes. After cooling, the excess thionyl chloride was distilled off under reduced pressure to give the corresponding acid chloride. Without purification, the product was dissolved in 100 ml of dichloromethane and a solution of 3.12 g of l-menthol in pyridine (100 ml) was added portionwise under cooling with ice water. After 3 hours, 400 ml of ice water was added, followed by extraction with dichloromethane. The dichloromethane layer was washed with water and dried over anhydrous sodium sulfate. The solvent was evaporated off to give 7.9 g of crude crystals. This product is a diastereoisomer of the l-menthyl ester.

iii) The above l-menthyl ester (7.9 g) was separated into two pure diastereoisomers by fractional recrystallization from ethyl acetate.

A) (−)-3-Oxo-2-(4-methoxyphenyl)isoindoline-1-acetic acid l-menthyl ester
M.p.: 179.5—180.5°C
Elemental analysis:
Calcd. for $C_{27}H_{33}NO_4$: C, 74.45; H, 7.64; N, 3.22
Found: C, 74.60; H, 7.66; N, 3.18
Optical rotation: $(\alpha)_D^{23}$ −82.6° (C=1.0 in chloroform)

B) (+)-3-Oxo-2-(4-methoxyphenyl)isoindoline-1-acetic acid l-menthyl ester
M.p.: 199—200°C
Elemental analysis:
Calcd. for $C_{27}H_{33}NO_4$: C, 74.45; H, 7.64; N, 3.22
Found: C, 74.65; H, 7.64; N, 3.17
Optical rotation: $[\alpha]_D^{23}$ +40.7° (C=1.0 in chloroform)

iv) The above ester compounds A) and B) were respectively hydrolyzed with 35% HCl in dioxane to give optically active carboxylic acids without racemization (recrystallization from methanol).

A) (−)-3-Oxo-2-(4-methoxyphenyl)isoindoline-1-acetic acid
M.p.: 245—246°C
Elemental analysis:
Calcd. for $C_{17}H_{15}NO_4$: C, 68.67; H, 5.08; N, 4.71
Found: C, 68.59; H, 5.04; N, 4.70
Optical rotation: $[\alpha]_D^{23}$ −60.3° (C=0.5 in methanol)

B) (+)-3-Oxo-2-(4-methoxyphenyl)isoindoline-1-acetic acid
M.p.: 245—246°C
Elemental analysis:
Calcd. for $C_{17}H_{15}NO_4$: C, 68.67; H, 5.08; N, 4.71
Found: C, 68.55; H, 5.02; N, 4.72
Optical rotation: $[\alpha]_D^{23}$ +60.2° (C=0.5 in methanol)

v) To a solution of (−) acetic acid ester (A) obtained above in dimethylformamide was added 1 equivalent of piperidine and 1.2 equivalents of diethyl phosphorocyanidate at 0°C, further followed by addition of triethylamine. After the mixture was stirred for 15 minutes, water was added, and the product was carried out with dichloromethane. The dichloromethane layer was extracted with water, dried over anhydrous sodium sulfate and the solvent was evaporated to give crude crystals. Recrystallization from ether gave the desired compound in optically active form in good yield.

A') (−)-2-(4-Methoxyphenyl)-3-piperidinocarbonylmethylisoindolin-1-one
M.p.: 110—111°C
Elemental analysis:
Calcd. for $C_{22}H_{24}N_2O_3$: C, 72.50; H, 6.64; N, 7.69
Found: C, 72.69; H, 6.65; N, 7.60
Optical rotation: $[\alpha]_D^{23}$ −134° (C=1.0 in chloroform)

vi) The above (+) acetic acid ester (B) was worked up in the same manner as (v) to give the following compound:

B') (+)-2-(4-Methoxyphenyl)-3-piperidinocarbonylmethylisoindolin-1-one

M.p.: 110—111°C

Elemental analysis:

Calcd. for $C_{22}H_{24}N_2O_3$: C, 72.50; H, 6.64; N, 7.69

Found: C, 72.55; H, 6.64; N, 7.66

Optical rotation: $[\alpha]_D^{23}$ +135° (C=1.0 in chloroform)

Example 14

a) 2,3,6,7-Tetrahydro-6-(4-methoxyphenyl)-5H-1,4-dithiino[2,3-C]pyrrole-5,7-dione (8.50 g) was suspended in methanol-tetrahydrofuran (1:1, 80 ml) and, under ice-cooling and stirring, sodium borohydride (0.88 g) was added. The mixture was stirred for 3 hours and then poured into ice water. After extraction with ethyl acetate, the extract was washed with water, dried (over Na_2SO_4) and evaporated to give 2,3,6,7-tetrahydro-7-hydroxy-6-(4-methoxyphenyl)-5H-1,4-dithiino[2,3-C]pyrrol-5-one (8.40 g) as crystals.

M.p.: 153—154°C.

Elemental analysis

Calcd. for $C_{13}H_{13}NO_3S_2$: C, 52.86; H, 4.44; N, 4.74

Found: C, 52.63; H, 4.40; N, 4.60

2,3,6,7-Tetrahydro-6-(4-methoxyphenyl)-5H-1,4-dithiino[2,3-C]pyrrole-5,7-dione which was used as the starting compound was prepared by the method of H. R. Schweizer [Helv. Chim. Acta, *52*, 2221 (1969)].

M.p.: 181—182°C.

b) 2,3,6,7-Tetrahydro-7-hydroxy-6-(4-methoxyphenyl)-5H-1,4-dithiino[2,3-C]pyrrol-5-one (1.48 g) and piperidinocarbonylmethylenetriphenylphosphorane (3.4 g) were dissolved in toluene (30 ml) under heating, and the solution was refluxed for 12 hours. The reaction mixture was concentrated and the residue was subjected to silica gel column chromatography (methylene chloride:ethyl acetate = 10:1). The thus-obtained crude crystals were recrystallized from ethyl acetate-ether to give crystals (1.45 g) of 2,3,6,7-tetrahydro-6-(4-methoxyphenyl)-7-piperidinocarbonylmethyl-5H-1,4-dithiino[2,3-C]pyrrol-5-one, melting at 163—164°C and 183—185°C (double melting).

Elemental analysis

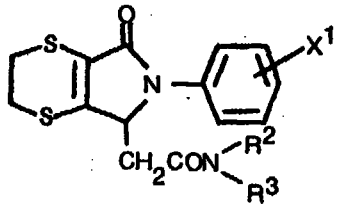
Calcd. for $C_{20}H_{24}N_2O_3S_2$: C, 59.38; H, 5.98; N, 6.93

Found: C, 59.32; H, 5.97; N, 6.71

Example 15

In the same manner as Example 14, there were obtained the compounds given in Table 4.

TABLE 4



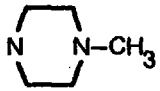
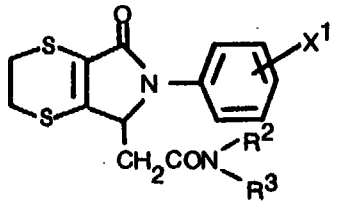
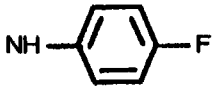
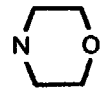
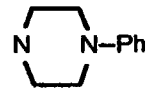
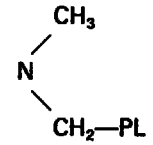
No.	X^1	$N(R^2)(R^3)$	M.p. (°C)	molecular formula	Elemental analysis Calcd. (Found)		
					C	H	N
1	p-Cl		186~189	$C_{19}H_{21}ClN_2O_2S_2$	55.80 (55.87)	5.18 (5.06)	6.85 (6.82)
2	p-Cl		182~183	$C_{20}H_{23}ClN_2O_2S_2$	56.79 (56.73)	5.48 (5.46)	6.62 (6.54)
3	p-OCH_3		135~136 / 147~148 *	$C_{21}H_{26}N_2O_3S_2$	60.26 (60.54)	6.26 (6.22)	6.69 (6.67)
4	H		200	$C_{19}H_{22}N_2O_2S_2$	60.93 (61.01)	5.92 (6.03)	7.48 (7.45)
5	H		152~153	$C_{20}H_{24}N_2O_2S_2$	61.82 (61.93)	6.23 (6.40)	7.21 (7.22)
6	p-OCH_3		173~175	$C_{19}H_{22}N_2O_3S_2$	58.43 (58.20)	5.68 (5.69)	7.17 (7.08)
7	p-Cl		185~186	$C_{18}H_{19}ClN_2O_2S_2$	54.74 (54.89)	4.85 (4.80)	7.09 (7.14)
8	H		204	$C_{18}H_{20}N_2O_2S_2$	59.97 (59.90)	5.59 (5.56)	7.77 (7.68)
9	p-OCH_3		109~114	$C_{20}H_{25}N_3O_3S_2$	57.26 (57.09)	6.01 (5.84)	10.02 (10.16)

TABLE 4 (continued)



No.	X^1	$N(R^2)(R^3)$	M.p. (°C)	molecular formula	Elemental analysis Calcd. (Found)		
					C	H	N
10	p-OCH_3	$N(C_2H_3)_2$	167~168	$C_{19}H_{24}N_2O_3S_2$	58.13 (58.08)	6.16 (5.97)	7.14 (7.19)
11	p-OCH_3		204~206	$C_{21}H_{19}FN_2O_3S_2$	58.59 (58.50)	4.45 (4.50)	6.51 (6.50)
12	p-OCH_3		157~158	$C_{18}H_{20}N_2O_3S_3$	52.92 (52.58)	4.93 (4.71)	6.86 (6.77)
13	p-OCH_3		142~144	$C_{19}H_{22}N_2O_4S_2$	56.14 (55.87)	5.46 (5.25)	6.89 (6.61)
14	p-Cl		183~184	$C_{24}H_{24}ClN_3O_2S_2$	59.30 (59.04)	4.98 (4.93)	8.65 (8.61)
15	p-OCH_3		152~153	$C_{23}H_{24}N_2O_3S$	62.70 (62.74)	5.49 (5.39)	6.36 (6.52)

* double melting point

Example 16.

6-(5-Chloro-2-pyridyl)-6,7-dihydro-7-hydroxy-5H-pyrrolo[3,4-b]pyrazin-5-one (786 mg) and piperidinocarbonylmethylenetriphenylphosphorane (1.17 g) were dissolved in dry toluene (15 ml) and the solution was refluxed for 6 hours. After cooling, the solvent was distilled off and ether was added to the residue to give crude crystals. The crystals were collected by filtration and recrystallized from dichloromethane-ether (1:5) to give 921 mg of 6-(5-chloro-3-pyridyl)-6,7-dihydro-7-piperidinocarbonylmethyl-5H-pyrrolo[3,4-b]-pyrazin-5-one.

M.p.: 212—213°C

Elemental analysis

Calcd. for $C_{18}H_{18}ClN_5O_2$: C, 58.14; H, 4.88; N, 18.84

Found: C, 58.15; H, 4.97; N, 18.81

Example 17

a) 6-(5-Chloro-2-pyridyl)-6,7-dihydro-7-hydroxy-5H-pyrrolo[3,4-b]pyrazin-5-one (1.05 g) and ethoxycarbonylmethylenetriphenylphosphorane (1.39 g) were dissolved in dry toluene (30 ml) and the solution was refluxed for 6 hours. After cooling, the solvent was distilled off and the residue was purified by silica gel column chromatography. Fractions eluted with dichloromethane-ethyl acetate (2:1) were collected and the solvent was distilled off to give crude crystals. Recrystallization from ether-dichloromethane (5:1) gave 1.2 g of 6-(5-chloropyridyl)-6,7-dihydro-7-ethoxycarbonylmethyl-5H-pyrrolo[3,4-b]pyrazin-5-one.

M.p.: 170—171°C

Elemental analysis

Calcd. for $C_{15}H_{13}ClN_4O_3$: C, 54.14; H, 3.94; N, 16.84

Found: C, 54.01; H, 4.00; N, 16.84

b) The compound (1.2 g) as obtained above in (a) was dissolved in 30 ml of methanol, to the solution 200 mg of sodium hydroxide was added and the mixture was heated at 60°C. After 1 hour, the reaction mixture was neutralized with 3 N hydrochloric acid-methanol and the resulting sodium chloride precipitated was filtered off. The filtrate was then concentrated to give a crystalline residue which was crude 6-(5-chloro-2-pyridyl)-6,7-dihydro-5H-pyrrolo[3,4-b]pyrazin-5-one-7-acetic acid. This product was not purified, but dissolved in 20 ml of dry dimethylformamide. The solution was ice-cooled, and thereto were added 0.5 g of N-methylpiperazine and 0.5 ml of triethylamine, and then 0.82 g of diethyl phosphorocyanidate. The mixture was stirred under ice-cooling for 3 hours. To the reaction mixture was added 100 ml of water, followed by extraction with dichloromethane. The dichloromethane layer was washed with water and dried over anhydrous sodium sulfate. The solvent was then distilled off to give crude crystals. This product was recrystallized from ether-dichloromethane (3:1) to give 1.0 g of 6-(5-chloro-2-pyridyl)-6,7-dihydro-7-(4-methylpiperazin-1-yl)carbonylmethyl-5H-pyrrolo[3,4-b]pyrazin-5-one hemihydrate.

M.p.: 244—246°C

Elemental analysis

Calcd. for $C_{18}H_{19}ClN_6O_2 \cdot \frac{1}{2}H_2O$: C, 54.61; H, 5.09; N, 21.23

Found: C, 54.80; H, 4.74; N, 21.21

Example 18

2-(4-Methoxyphenyl)-3-hydroxy-4,5,6,7-tetrahydroisoindolin-1-one (2.59 g) and piperidinocarbonylmethylenetriphenylphosphorane (4.6 g) were dissolved in 50 ml of dry toluene and the solution was refluxed gently for 20 hours. After cooling, the solvent was distilled off and the residue was purified by silica gel column chromatography. Fractions eluted with dichloromethane-ethyl acetate (5:1) were collected and concentrated to give crude crystals. This product was recrystallized from ether-hexane (1:3) to give 1.87 g of 2-(4-methoxyphenyl)-3-piperidinocarbonylmethyl-4,5,6,7-tetrahydroisoindolin-1-one.

M.p.: 101—102°C

Elemental analysis

Calcd. for $C_{22}H_{28}N_2O_3$: C, 71.71; H, 7.66; N, 7.60

Found: C, 71.83; H, 7.59; N, 7.75

Example 19

2-(4-Chlorophenyl)-3-hydroxy-4,5,6,7-tetrahydroisoindolin-1-one was worked up in the same manner as Example 18 to give 2-(4-chlorophenyl)-3-piperidinocarbonylmethyl-4,5,6,7-tetrahydroisoindolin-1-one.

M.p.: 120—122°C

Elemental analysis

Calcd. for $C_{21}H_{25}ClN_2O_2$: C, 67.64; H, 6.75; N, 7.51

Found: C, 67.91; H, 6.74; N, 7.58

Example 20

2-(4-Chlorophenyl)-3-hydroxy-4,5,6,7-tetrahydroisoindolin-1-one was worked up in the same manner as Example 18 to give 2-(4-chlorophenyl)-3-hexamethyleneiminocarbonylmethyl-4,5,6,7-tetrahydroisoindolin-1-one.

M.p.: 169—170°C

Elemental analysis

Calcd. for $C_{22}H_{27}ClN_2O_2$:	C, 68.29;	H, 7.03;	N, 7.24
Found:	C, 68.46;	H, 6.87;	N, 7.28

Example 21

In the same manner as Example 18, there were obtained the following compounds:

i) 2-(4-Methoxyphenyl)-3-pyrrolidinocarbonylmethyl-4,5,6,7-tetrahydroisoindolin-1-one.

M.p.: 114—115°C.

Elemental analysis

Calcd. for $C_{21}H_{26}N_2O_3$:	C, 71.16;	H, 7.39;	N, 7.90
Found:	C, 71.19;	H, 7.21;	N, 8.05

ii) 2-(4-Methoxyphenyl)-3-hexamethyleneiminocarbonylmethyl-4,5,6,7-tetrahydroisoindolin-1-one.

M.p.: 113—114°C.

Elemental analysis

Calcd. for $C_{23}H_{30}N_2O_3$:	C, 72.22;	H, 7.91;	N, 7.32
Found:	C, 72.30;	H, 7.80;	N, 7.31

Example 22

i) Ethoxycarbonylmethylenetriphenylphosphorane (3.0 g) was added to a solution of 2-(4-methoxyphenyl)-3-hydroxy-4,5,6,7-tetrahydroisoindolin-1-one (2.59 g) in toluene (30 ml) and the solution was refluxed gently for 48 hours. After cooling, the solvent was distilled off and the residue was dissolved in 30 ml of methanol. Potassium carbonate (3 g) and water (10 ml) were added and the mixture was refluxed for an hour. After cooling, the methanol was distilled off, 100 ml of water and 100 ml of dichloromethane were added and the mixture was stirred well. The aqueous layer was separated and acidified with 5% hydrochloric acid to give crystals, which were washed with water, dried and recrystallized from methanol-ether (1:3) to give 24.6 g of 2-(4-methoxyphenyl)-3-oxo-4,5,6,7-tetrahydroisoindoline-1-acetic acid.

M.p.: 203—204°C.

Elemental analysis

Calcd. for $C_{17}H_{19}NO_4$:	C, 67.76;	H, 6.36;	N, 4.65
Found:	C, 68.01;	H, 6.40;	N, 4.91

ii) In the same manner as above, there was obtained 2-(4-chlorophenyl)-3-oxo-4,5,6,7-tetrahydroisoindoline-1-acetic acid.

M.p.: 177—178°C.

Elemental analysis

Calcd. for $C_{16}H_{16}ClNO_3$:	C, 62.85;	H, 5.27;	N, 4.58
Found:	C, 62.88;	H, 5.15;	N, 4.68

Example 23

2-(4-Methoxyphenyl)-5-nitro-3-piperidinocarbonylmethylisoindolin-1-one and 2-(4-methoxyphenyl)-6-nitro-3-piperidinocarbonylmethylisoindolin-1-one

N-(4-methoxyphenyl)-4-nitrophthalamide (12 g) was suspended in a mixture of methanol (80 ml) and tetrahydrofuran (80 ml) and, under ice-cooling and stirring, sodium borohydride (1.6 g) was added. Water (300 ml) was added to the mixture and crude crystals were collected by filtration to give a mixture (11 g) of 3-hydroxy-2-(4-methoxyphenyl)-5-nitroisoindolin-1-one and 3-hydroxy-2-(4-methoxyphenyl)-6-nitroisoindolin-1-one. The mixture (6.0 g) thus obtained and piperidinocarbonylmethylenetriphenylphosphoran (9.3 g) were dissolved in toluene (200 ml) under heating, and the solution was refluxed for 3 hours. After cooling, crystals separated were collected by filtration and recrystallized from toluene to give 2.2 g of 2-(4-methoxyphenyl)-6-nitro-3-piperidinocarbonylmethylisoindolin-1-one.

M.p.: 209—210°C.

Elemental analysis

Calcd. for $C_{22}H_{23}N_3O_5$:	C, 64.53;	H, 5.66;	N, 10.26
Found:	C, 64.37;	H, 5.51;	N, 10.24

NMR δ (in $CDCl_3$): 7.88 (1H, d, 4-H), 8.38 (1H, dd, 5-H), 8.65 (1H, d, 7-H).

The mother liquor obtained above was concentrated and the residue was subject to purification by column chromatography on silica gel and eluted with toluene-ethyl acetate.

Crude crystals obtained from initially eluted fractions were recrystallized from ethyl acetate to give 2.0 g of the corresponding 5-nitro compound.

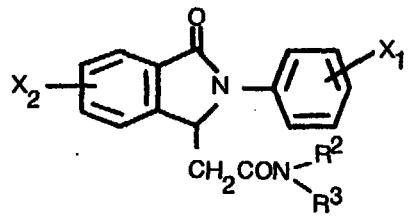
M.p.: 187—189°C.
Elemental analysis
Calcd. for $C_{12}H_{23}N_3O_5$: C, 64.53; H, 5.66; N, 10.26
Found: C, 64.26; H, 5.57; N, 10.22
NMR δ (in $CDCl_3$): 8.01 (1H, d, 7-H), 8.34 (1H, dd, 6-H), 8.52 (1H, d, 4-H).

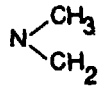
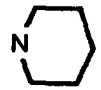
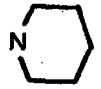
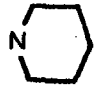
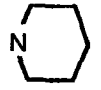
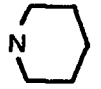
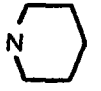
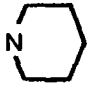
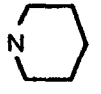
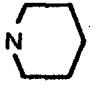
From the subsequent fractions a mixture (2.4 g) of 5-nitro compound and 6-nitro compound was obtained. Crude crystals obtained from further subsequent fractions were recrystallized from toluene to give 1.0 g of 6-nitro compound.

Example 24

In the same manner as Example 23, there were obtained the compounds listed in Table 5.

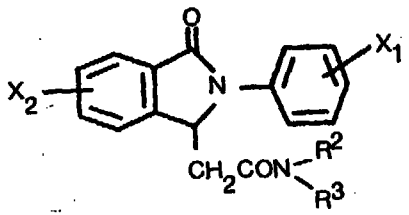
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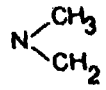
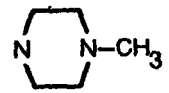


No.	X_1	X_2		M.P. (°C)	molecular formula	Elemental analysis Calcd. (Found)		
						C	H	N
1	p-OCH_3	4-NO_2		197~198	$C_{22}H_{23}N_3O_5$	64.53 (64.52)	5.66 (5.93)	10.26 (10.33)
2	p-OCH_3	5-NH_2		239~243	$C_{22}H_{25}N_3O_3 \cdot \frac{1}{4}H_2O$	68.82 (68.96)	6.69 (6.85)	10.95 (10.81)
3	p-OCH_3	6-NH_2		198~200	$C_{22}H_{25}N_3O_3 \cdot \frac{1}{4}H_2O$	68.82 (69.09)	6.69 (6.72)	10.95 (10.76)
4	p-OCH_3	5-NHAc		198~222	$C_{24}H_{27}N_3O_4$	68.39 (68.23)	6.46 (6.41)	9.97 (9.75)
5	p-OCH_3	5-NHAc		250~252	$C_{24}H_{27}N_3O_4$	68.39 (68.27)	6.46 (6.50)	9.97 (9.78)
6	p-OCH_3	5-Cl		153~154	$C_{22}H_{23}ClN_2O_3$	66.24 (66.27)	5.81 (5.89)	7.02 (7.00)
7	p-OCH_3	6-Cl		144~146	$C_{22}H_{23}ClN_2O_3$	66.24 (66.31)	5.81 (5.79)	7.02 (7.10)
8	p-OCH_3	6-$COOCH_3$		139~141, * 162~164	$C_{24}H_{26}N_2O_5$	68.23 (68.27)	6.20 (6.19)	6.63 (6.56)
9	p-OCH_3	6-$CONH_2$		273~280	$C_{23}H_{25}N_3O_4$	67.79 (67.76)	6.18 (6.11)	10.31 (10.22)

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TABLE 5 (continued)



No.	X_1	X_2		M.P. (°C)	molecular formula	Elemental analysis Calcd. (Found)		
						C	H	N
10	p-OCH_3	6-COOH		232~236	$C_{23}H_{24}N_2O_5$	67.63 (67.72)	5.92 (5.76)	6.86 (6.79)
11	p-OCH_3	5-COOH		249~256	$C_{23}H_{24}N_2O_5$	67.63 (67.51)	5.92 (5.89)	6.86 (6.62)
12	p-OCH_3	5,6-di-Cl		172~174	$C_{22}H_{22}Cl_2N_2O_3$	60.97 (60.86)	5.12 (5.14)	6.47 (6.31)
13	p-OCH_3	5-Cl		169~171	$C_{22}H_{24}ClN_3O_3$	63.84 (63.88)	5.84 (5.80)	10.15 (10.09)

* double melting point

Example 25

In the same manner as Example 11, 2-(7-chloro-1,8-naphthyridin-2-yl)-3-piperidinocarbonylmethylisoindolin-1-one was obtained from 2-(7-chloro-1,8-naphthyridin-2-yl)-3-hydroxyisoindolin-1-one.

M.p.: 217—218°C

Elemental analysis

Calcd. for $C_{23}H_{21}ClN_4O_2$: C, 65.63; H, 5.03; N, 13.31

Found: C, 65.88; H, 4.93; N, 13.40

Example 26

In the same manner as Example 14, 2,3,6,7-tetrahydro-6-(4-fluorophenyl)-7-piperidinocarbonylmethyl-5H-1,4-dithiino[2,3-c]pyrrol-5-one was obtained from 2,3,6,7-tetrahydro-7-hydroxy-6-(4-fluorophenyl)-5H-1,4-dithiino[2,3-c]pyrrol-5-one.

M.p.: 173—192°C.

Elemental analysis

Calcd. for $C_{19}H_{21}FN_2O_2S_2$: C, 58.14; H, 5.39; N, 7.14

Found: C, 58.13; H, 5.21; N, 7.10

Example 27

i) In a similar manner to Example 13, 2,3,6,7-tetrahydro-6-(4-methoxyphenyl)-5-oxo-5H-1,4-dithiino[2,3-c]pyrrol-7-acetic acid was resolved by the conventional method using cinchonine and optically active (−)-2,3,6,7-tetrahydro-6-(4-methoxyphenyl)-5-oxo-5H-1,4-dithiino[2,3-c]pyrrol)-7-acetic acid was obtained.

Optical rotation: $[\alpha]_D^{23} = -58.6°$ (C = 1.0 in methanol).

M.p.: 204—205°C.

Elemental analysis

Calcd. for $C_{15}H_{15}NO_4S_2$: C, 53.39; H, 4.48; N, 4.15

Found: C, 53.62; H, 4.43; N, 4.03

ii) The (−)-carboxylic acid obtained above was worked up in the same manner as Example 16 (v) to give (−)-2,3,6,7-tetrahydro-6-(4-methoxyphenyl)-7-piperidinocarbonylmethyl-5H-5H-1,4-dithiino[2,3-c]pyrrol-5-one.

Optical rotation: $[\alpha]_D^{23} = -156°$ (C = 0.1 in chloroform).

M.p.: 191—192°C.

Elemental analysis

Calcd. for $C_{20}H_{24}N_2O_3S_2$: C, 59.38; H, 5.98; N, 6.93

Found: C, 59.36; H, 5.99; N, 6.84

Example 28

In the same manner as Example 17, 2-(7-chloro-1,8-naphthyridin-2-yl)-3-(4-methylpiperidin-1-yl)carbonylmethylisoindolin-1-one was obtained from 3-oxo-2-(7-chloro-1,8-naphthyridin-2-yl)isoindoline-1-acetic acid and N-methylpiperidine.

M.p.: 212—213°C.

Elemental analysis

Calcd. for $C_{23}H_{22}ClN_5O_2$: C, 63.37; H, 5.09; N, 16.07

Found: C, 63.36; H, 5.11; N, 16.09

Example 29

In the same manner as Example 14(b), 2-(2-methylquinolin-4-yl)-3-piperidinocarbonylmethylisoindolin-1-one was obtained from 2-(2-methylquinolin-4-yl)-3-hydroxyisoindolin-1-one and piperidinocarbonylmethylenetriphenylphosphorane.

M.p.: 200—202°C.

Elemental analysis

Calcd. for $C_{25}H_{25}N_3O_2$: C, 75.16; H, 63.31; N, 10.52

Found: C, 75.21; H, 6.33; N, 10.46

Example 30

In the same manner as Example 18, 5-chloro-2-(7-chloro-1,8-naphthyridin-2-yl)-3-piperidinocarbonylmethylisoindolin-1-one was obtained from 5-chloro-3-hydroxy-2-(7-chloro-1,8-naphthyridin-2-yl)isoindolin-1-one and piperidinocarbonylmethylenetriphenylphosphorane.

M.p.: 272—274°C.

Elemental analysis

Calcd. for $C_{23}H_{20}Cl_2N_4O_2$: C, 60.67; H, 4.43; N, 12.30

Found: C, 60.54; H, 4.34; N, 12.25

Example 31

In the same manner as Example 18, 6-chloro-2-(7-chloro-1,8-naphthyridin-2-yl)-3-piperidinocarbonylmethylisoindolin-1-one was obtained from 6-chloro-3-hydroxy-2-(7-chloro-1,8-naphthyridin-2-yl)isoindolin-1-one.

M.p.: 295—297°C.

Elemental analysis

Calcd. for $C_{23}H_{20}Cl_2N_4O_2$:	C, 60.67;	H, 4.43;	N, 12.30
Found:	C, 60.60;	H, 4.25;	N, 12.21

Example 32

Ethyl 6-chloro-3-oxo-2-(4-methoxyphenyl)isoindoline-1-acetate (1.0 g) and N-methylpiperazine (1.3 g) were heated at 110°C for 4 hours in a nitrogen stream. After cooling, water (40 ml) were added to the reaction mixture and crystals separated were collected by filtration, washed with water and then dried. Recrystallization from ether gave 5-chloro-2-(4-methoxyphenyl)-3-(4-methylpiperazin-1-yl)carbonylmethylisoindolin-1-one (1.0 g). The product was identified with the compound No. 13 in Table 5 and melted at 169—171°C.

Formulation Example 1

(1) 2-(4-Chlorophenyl)-3-piperidinocarbonylmethylisoindolin-1-one	1 g
(2) Lactose	89 g
(3) Corn starch	29 g
(4) Magnesium stearate	1 g
	120 g for 1000 tablets

The whole amounts of (1) and (2) and 17 g of corn starch (3) were blended and combined with a paste prepared from 7 g of corn starch. The mixture was granulated and 5 g of corn starch and the indicated amount of (4) were further added. This composition was molded on a compression tablet machine to give 1000 tablets measuring 7 mm in diameter and each containing 1 mg of (1).

Formulation Example 2

(1) 6-Chloro-2-(4-methoxyphenyl)-3-(4-methylpiperazin-1-yl)-carbonylisoindolin-1-one	2 g
(2) Lactose	88 g
(3) Corn starch	29 g
(4) Magnesium stearate	1 g
	120 g for 1000 tablets

In the same manner as Formulation Example 1, there were produced 1000 tablets measuring 7 mm in diameter and each containing 2 mg of (1).

Reference Example 1

A solution of 56.5 g of chloroacetyl chloride in toluene (400 ml) was cooled to 5°C, and a solution of 85.2 g of piperidine in toluene (200 ml) was added portionwise. The mixture was stirred at 5°C for 3 hours and at 25°C for an hour. The resulting crystals precipitated were filtered off, 117 g of triphenylphosphine was added to the filtrate, and the mixture was heated at 80°C for 6 hours. After cooling, the crystals precipitated were collected by filtration to give 125 g of crystals of piperidinocarbonylmethyltriphenylphosphonium chloride. This product was dissolved in 1 l of ice water and under ice-cooling 500 ml of 0.5 N sodium hydroxide was added. The crystals precipitated were collected by filtration, washed with water and dried. Recrystallization from methylene chloride-ether (1:10) gave crystals (91 g) of piperidinocarbonylmethylenetriphenylphosphorane.

M.p.: 180—188°C.

Elemental analysis

Calcd. for $C_{25}H_{26}NOP$:	C, 77.50;	H, 9.37;	N, 3.62
Found:	C, 77.71;	H, 9.61;	N, 3.54

Reference Example 2

In the same manner as Reference Example 1, there were obtained the following compounds:

i) Pyrrolidinocarbonylmethylenetriphenylphosphorane

M.p.: 202—204°C.

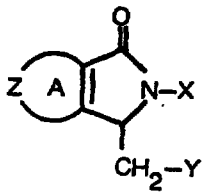
Elemental analysis

Calcd. for $C_{24}H_{24}NOP$:	C, 77.19;	H, 6.48;	N, 3.75
Found:	C, 77.10;	H, 6.58;	N, 3.79

ii) Hexamethyleneiminocarbonylmethylenetriphenylphosphorane
M.p.: 189—192°C.
Elemental analysis
Calcd. for $C_{26}H_{28}NOP$: C, 77.78; H, 7.03; N, 3.49
Found: C, 77.49; H, 6.96; N, 3.49

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

1. A compound of the formula (I)

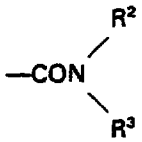


I

wherein

X is aryl, naphthyridinyl, pyridyl or quinolyl, which may optionally be substituted by 1 to 3 of halogen, C_{1-4} alkyl, C_{1-4} alkoxy, methylenedioxy, phenoxy, benzyloxy, hydroxyl, C_{2-5} alkanoyloxy, amino, di-C_{1-4} alkylamino, ω-hydroxy-C_{1-3} alkyl, C_{2-5} alkanoyl, benzoyl, amino, nitro, cyano, trifluoromethyl, C_{1-4} alkylthio, C_{2-5} alkanoyloxy-C_{1-3} alkyl, C_{2-5} alkanoylamino, methoxycarbonyl or ethoxycarbonyl;

Y is the carboxyl group —$COOR^1$ wherein R^1 is C_{1-4} alkyl, phenyl C_{1-4} alkyl or phenyl, or



wherein R^2 and R^3 are the same or different and each is hydrogen, C_{1-4} alkyl, phenyl-C_{1-4} alkyl, phenyl, thiazolyl or benzothiazolyl, and R^2 and R^3 may each be substituted by halogen, hydroxy, C_{1-4} alkoxy, C_{2-5} alkoxycarbonyl or di-C_{1-4} alkylamino; and

R^2 and R^3 may, together with the adjacent N atom, form a 5- to 7-membered cyclic amino group which may include N, O or S atom as a second hetero-atom, in addition to the said adjacent N atom, and which may have 1 to 2 substituent(s) of hydroxyl, C_{1-4} alkoxy, C_{1-4} alkyl, C_{2-5} alkoxycarbonyl, phenyl-C_{1-4} alkyl, phenyl, piperidino or pyridyl;

Z is —CH=CH—CH=CH—; —S—$(CH_2)_2$—S—, —N=CH—CH=N— or —$(CH_2)_4$—; ring A may be optionally substituted by 1 or 2 substituent(s) of halogen, nitro, amino, C_{2-5} alkanoylamino, C_{2-5} alkoxycarbonyl, carboxyl or carbamoyl;

or a salt thereof.

2. A compound according to claim 1, wherein X is phenyl or naphthyridinyl, which may be substituted with C_{1-4} alkoxy or halogen.

3. A compound according to claim 1, wherein Y is —CO—NR_2R_3.

4. A compound according to claim 1, wherein Z is —CH=CH—CH=CH—.

5. A compound according to claim 3, wherein Y is a cyclic aminocarbonyl.

6. A compound according to claim 1, wherein X is a phenyl which is substituted by C_{1-4} alkoxy or halogen; Y is a cyclic aminocarbonyl; Z is —CH=CH—CH=CH—; and ring A may be substituted with halogen.

7. A compound according to claim 1, wherein the compound is 5-chloro-2-(4-methoxyphenyl)-3-(4-methylpiperazine-1-yl)-carbonylmethylisoindolin-1-one.

8. A compound according to claim 1, wherein the compound is 2-(4-methoxyphenyl)-3-piperidinocarbonylmethylisoindolin-1-one.

9. A compound according to claim 1, wherein the compound is 5-chloro-2-(4-methoxyphenyl)-3-piperidinocarbonylmethylisoindolin-1-one.

10. A compound according to claim 1, wherein the compound is 5-nitro-2-(4-methoxyphenyl)-3-piperidinocarbonylmethylisoindolin-1-one.

11. A compound according to claim 1, wherein the compound is 5-chloro-2-(7-chloro-1,8-naphthyridin-2-yl)-3-piperidinocarbonylmethylisoindolin-1-one.

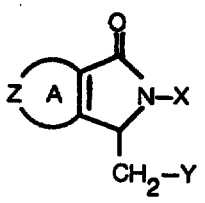
12. A compound according to claim 1, wherein the compound is 6-chloro-2-(7-chloro-1,8-naphthyridin-2-yl)-3-piperidinocarbonylmethylisoindolin-1-one.

13. A process for the production of a compound as claimed in claim 1, or a salt thereof, which comprises hydrolyzing a compound of the formula (II)

ii) Hexamethyleneiminocarbonylmethylenetriphenylphosphorane
M.p.: 189—192°C.
Elemental analysis
Calcd. for $C_{26}H_{28}NOP$: C, 77.78; H, 7.03; N, 3.49
Found: C, 77.49; H, 6.96; N, 3.49

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

1. A compound of the formula (I)

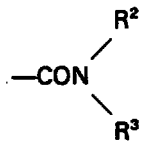


I

wherein

X is aryl, naphthyridinyl, pyridyl or quinolyl, which may optionally be substituted by 1 to 3 of halogen, C_{1-4} alkyl, C_{1-4} alkoxy, methylenedioxy, phenoxy, benzyloxy, hydroxyl, C_{2-5} alkanoyloxy, amino, di-C_{1-4} alkylamino, ω-hydroxy-C_{1-3} alkyl, C_{2-5} alkanoyl, benzoyl, amino, nitro, cyano, trifluoromethyl, C_{1-4} alkylthio, C_{2-5} alkanoyloxy-C_{1-3} alkyl, C_{2-5} alkanoylamino, methoxycarbonyl or ethoxycarbonyl;

Y is the carboxyl group —$COOR^1$ wherein R^1 is C_{1-4} alkyl, phenyl C_{1-4} alkyl or phenyl, or



wherein R^2 and R^3 are the same or different and each is hydrogen, C_{1-4} alkyl, phenyl-C_{1-4} alkyl, phenyl, thiazolyl or benzothiazolyl, and R^2 and R^3 may each be substituted by halogen, hydroxy, C_{1-4} alkoxy, C_{2-5} alkoxycarbonyl or di-C_{1-4} alkylamino; and

R^2 and R^3 may, together with the adjacent N atom, form a 5- to 7-membered cyclic amino group which may include N, O or S atom as a second hetero-atom, in addition to the said adjacent N atom, and which may have 1 to 2 substituent(s) of hydroxyl, C_{1-4} alkoxy, C_{1-4} alkyl, C_{2-5} alkoxycarbonyl, phenyl-C_{1-4} alkyl, phenyl, piperidino or pyridyl;

Z is —CH=CH—CH=CH—; —S—$(CH_2)_2$—S—, —N=CH—CH=N— or —$(CH_2)_4$—; ring A may be optionally substituted by 1 or 2 substituent(s) of halogen, nitro, amino, C_{2-5} alkanoylamino, C_{2-5} alkoxycarbonyl, carboxyl or carbamoyl;

or a salt thereof.

2. A compound according to claim 1, wherein X is phenyl or naphthyridinyl, which may be substituted with C_{1-4} alkoxy or halogen.

3. A compound according to claim 1, wherein Y is —CO—NR_2R_3.

4. A compound according to claim 1, wherein Z is —CH=CH—CH=CH—.

5. A compound according to claim 3, wherein Y is a cyclic aminocarbonyl.

6. A compound according to claim 1, wherein X is a phenyl which is substituted by C_{1-4} alkoxy or halogen; Y is a cyclic aminocarbonyl; Z is —CH=CH—CH=CH—; and ring A may be substituted with halogen.

7. A compound according to claim 1, wherein the compound is 5-chloro-2-(4-methoxyphenyl)-3-(4-methylpiperazine-1-yl)-carbonylmethylisoindolin-1-one.

8. A compound according to claim 1, wherein the compound is 2-(4-methoxyphenyl)-3-piperidinocarbonylmethylisoindolin-1-one.

9. A compound according to claim 1, wherein the compound is 5-chloro-2-(4-methoxyphenyl)-3-piperidinocarbonylmethylisoindolin-1-one.

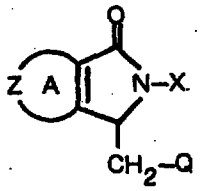
10. A compound according to claim 1, wherein the compound is 5-nitro-2-(4-methoxyphenyl)-3-piperidinocarbonylmethylisoindolin-1-one.

11. A compound according to claim 1, wherein the compound is 5-chloro-2-(7-chloro-1,8-naphthyridin-2-yl)-3-piperidinocarbonylmethylisoindolin-1-one.

12. A compound according to claim 1, wherein the compound is 6-chloro-2-(7-chloro-1,8-naphthyridin-2-yl)-3-piperidinocarbonylmethylisoindolin-1-one.

13. A process for the production of a compound as claimed in claim 1, or a salt thereof, which comprises hydrolyzing a compound of the formula (II)

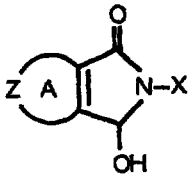
* C L M S *



II

wherein each symbol is as defined in claim 1 and Q is —COOR^4 (R^4 is a lower alkyl) or —CN, and, if necessary, esterifying or amidating the resulting hydrolysate compound.

14. A process for the production of a compound as claimed in claim 1, or a salt thereof, which comprises reacting a compound of the formula (III)



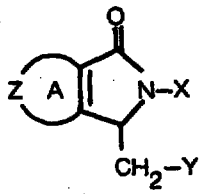
III

wherein Z, X and A are as defined in claim 1, with a compound of the formula $Ph_3P=CHY$ wherein Y is as defined in claim 1.

15. A pharmaceutical composition which comprises (a) as the active ingredient, an antianxiety-effective amount of at least one compound as defined in claim 1, or a physiologically acceptable salt thereof, and (b) pharmaceutically acceptable carriers therefor.

Claims for the Contracting State: AT

1. A process for the production of a compound of the formula (I)

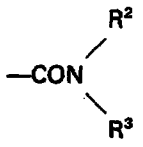


I

wherein

X is aryl, naphthyridinyl, pyridyl, or quinolyl, which may optionally be substituted by 1 to 3 of halogen, C_{1-4} alkyl, C_{1-4} alkoxy, methylenedioxy, phenoxy, benzyloxy, hydroxyl, C_{2-5} alkanoyloxy, amino, di-C_{1-4} alkylamino, ω-hydroxy-C_{1-3} alkyl, C_{2-5} alkanoyl, benzoyl, amino, nitro, cyano, trifluoromethyl, C_{1-4} alkylthio, C_{2-5} alkanoyloxy-C_{1-3} alkyl, C_{2-5} alkanoylamino, methoxycarbonyl or ethoxycarbonyl;

Y is the carboxyl group —COOR^1 wherein R^1 is C_{1-4} alkyl, phenyl C_{1-4} alkyl or phenyl, or



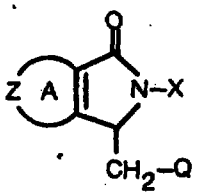
wherein R^2 and R^3 are the same or different and each is hydrogen, C_{1-4} alkyl, phenyl-C_{1-4} alkyl, phenyl, thiazolyl or benzothiazolyl, and R^2 and R^3 may each be substituted by halogen, hydroxy, C_{1-4} alkoxy, C_{2-5} alkoxycarbonyl or di-C_{1-4} alkylamino, and

R^2 and R^3 may, together with the adjacent N atom, form a 5- to 7-membered cyclic amino group which may include N, O or S atom as a second hetero-atom, in addition to the said adjacent N atom, and which may have 1 to 2 substituent(s) of hydroxyl, C_{1-4} alkoxy, C_{1-4} alkyl, C_{2-5} alkoxycarbonyl, phenyl-C_{1-4} alkyl, phenyl, piperidino or pyridyl;

Z is —CH=CH—CH=CH—; —S—$(CH_2)_2$—S—, —N=CH—CH=N— or —$(CH_2)_4$—; ring A may be optionally substituted by 1 or 2 substituent(s) of halogen, nitro, amino, C_{2-5} alkanoylamino, C_{2-5} alkoxycarbonyl, carboxyl or carbamoyl;

or a salt thereof, which comprises hydrolyzing a compound of the formula (II)

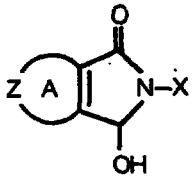
* C L M S *



II

wherein each symbol is as defined hereinbefore and Q is —COOR^4 (R^4 is a lower alkyl) or —CN, and, if necessary, esterifying or amidating the resulting hydrolysate compound.

2. A process for the production of a compound of the formula (I) as defined in claim 1, or a salt thereof, which comprises reacting a compound of the formula (III)



III

wherein Z, X and A are as defined in claim 1, with a compound of the formula $Ph_3P=CHY$, wherein Y is as defined in claim 1.

3. A process according to claim 1 or 2, wherein X is phenyl or naphthyridinyl, which may be substituted with C_{1-4} alkoxy or halogen.

4. A process according to claim 1 or 2, wherein Y is —CONR$_2$R$_3$.

5. A process according to claim 1 or 2, wherein Z is —CH=CH—CH=CH—.

6. A process according to claim 4, wherein Y is a cyclic aminocarbonyl.

7. A process according to claim 1 or 2, wherein X is a phenyl which is substituted by C_{1-4} alkoxy or halogen; Y is a cyclic aminocarbonyl; Z is —CH=CH—CH=CH—; and ring A may be substituted with halogen.

8. A process according to claim 1 or 2, wherein the compound produced is 5-chloro-2-(4-methoxyphenyl)-3-(4-methylpiperazine-1-yl)-carbonylmethylisoindolin-1-one.

9. A process according to claim 1 or 2, wherein the compound produced is 2-(4-methoxyphenyl)-3-piperidinocarbonylmethylisoindolin-1-one.

10. A process according to claim 1 or 2, wherein the compound produced is 5-chloro-2-(4-methoxyphenyl)-3-piperidinocarbonylmethylisoindolin-1-one.

11. A process according to claim 1 or 2, wherein the compound produced is 5-nitro-2-(4-methoxyphenyl)-3-piperidinocarbonylmethylisoindolin-1-one.

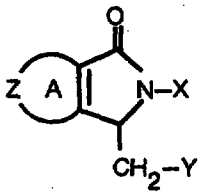
12. A process according to claim 1 or 2, wherein the compound produced is 5-chloro-2-(7-chloro-1,8-naphthyridin-2-yl)-3-piperidinocarbonylmethylisoindolin-1-one.

13. A process according to claim 1 or 2, wherein the compound produced is 6-chloro-2-(7-chloro-1,8-naphthyridin-2-yl)-3-piperidinocarbonylmethylisoindolin-1-one.

14. A pharmaceutical composition which comprises (a) as the active ingredient, an antianxiety-effective amount of at least one compound corresponding to the formula (I) as defined in claim 1, or a physiologically acceptable salt thereof, and (b) pharmaceutically acceptable carriers therefor.

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

1. Verbindung der Formel (I)



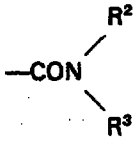
I

worin

X gegebenenfalls durch 1 bis 3 Substituenten ausgewählt aus Halogen, C_{1-4} Alkyl, C_{1-4} Alkoxy, Methylendioxy, Phenoxy, Benzyloxy, Hydroxyl, C_{2-5} Alkanoyloxy, Amino, Di-C_{1-4} Alkylamino, ω-Hydroxy-C_{1-3} Alkyl, C_{2-5} Alkanoyl, Benzoyl, Amino, Nitro, Cyano, Trifluormethyl, C_{1-4} Alkylthio, C_{2-5} Alkanoyloxy-C_{1-3} Alkyl, C_{2-5} Alkanoylamino, Methoxycarbonyl oder Äthoxycarbonyl substituiertes Aryl, Naphthyridinyl, Pyridyl oder Chinolyl ist;

Y die Carboxylgruppe —COOR^1 darstellt, worin R^1 für C_{1-4} Alkyl, Phenyl-C_{1-4} Alkyl oder Phenyl steht oder

* C L M S *



bedeutet, worin R^2 und R^3 gleich oder verschieden sind und jeweils Wasserstoff, C_{1-4} Alkyl, Phenyl-C_{1-4} Alkyl, Phenyl, Thiazolyl oder Benzothiazolyl darstellen und R^2 und R^3 jeweils durch Halogen, Hydroxy, C_{1-4} Alkoxy, C_{2-5} Alkoxycarbonyl oder Di-C_{1-4} Alkylamino substituiert sein können und

R^2 und R^3 zusammen mit dem angrenzenden N-Atom eine 5- bis 7-gliedrige cyclische Aminogruppe bilden können, die ein N-, O- oder S-Atom als zweites Heteroatom zusätzlich zu dem genannten angrenzenden N-Atom enthalten kann und die 1 bis 2 Substituenten ausgewählt aus Hydroxyl, C_{1-4} Alkoxy, C_{1-4} Alkyl, C_{2-5} Alkoxycarbonyl, Phenyl-C_{1-4} Alkyl, Phenyl, Piperidino oder Pyridyl aufweisen kann;

Z für —CH=CH—CH=CH—; —S—$(CH_2)_2$—S—, —N=CHCH=N— oder —$(CH_2)_4$— steht; der Ring A gegebenenfalls durch 1 oder 2 Substituenten von Halogen, Nitro, Amino, C_{2-5} Alkanoylamino, C_{2-5} Alkoxycarbonyl, Carboxyl oder Carbamoyl aufweist;

oder ein Salz derselben.

2. Verbindung nach Anspruch 1, worin X für gegebenenfalls durch C_{1-4} Alkoxy oder Halogen substituiertes Phenyl oder Naphthyridinyl steht.

3. Verbindung nach Anspruch 1, worin Y —CO—NR_2R_3 darstellt.

4. Verbindung nach Anspruch 1, worin Z —CH=CH—CH=CH— ist.

5. Verbindung nach Anspruch 3, worin Y ein cyclisches Aminocarbonyl darstellt.

6. Verbindung nach Anspruch 1, worin X für ein durch C_{1-4} Alkoxy oder Halogen substituiertes Phenyl steht; Y ein cyclisches Aminocarbonyl bedeutet; Z —CH=CH—CH=CH— darstellt und der Ring A gegebenenfalls durch Halogen substituiert ist.

7. Verbindung nach Anspruch 1, worin die Verbindung 5-Chlor-2-(4-methoxyphenyl)-3-(4-methylpiperazin-1-yl)-carbonylmethylisoindolin-1-on ist.

8. Verbindung nach Anspruch 1, worin die Verbindung 2-(4-Methoxyphenyl)-3-piperidinocarbonylmethylisoindolin-1-on ist.

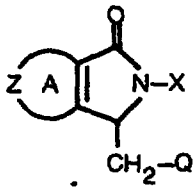
9. Verbindung nach Anspruch 1, worin die Verbindung 5-Chlor-2-(4-methoxyphenyl)-3-piperidinocarbonylmethylisoindolin-1-on ist.

10. Verbindung nach Anspruch 1, worin die Verbindung 5-Nitro-2-(4-methoxyphenyl)-3-piperidinocarbonylmethylisoindolin-1-on ist.

11. Verbindung nach Anspruch 1, worin die Verbindung 5-Chlor-2-(7-chlor-1,8-naphthyridin-2-yl)-3-piperidinocarbonylmethylisoindolin-1-on ist.

12. Verbindung nach Anspruch 1, worin die Verbindung 6-Chlor-2-(7-chlor-1,8-naphthyridin-2-yl)-3-piperidinocarbonylmethylisoindolin-1-on ist.

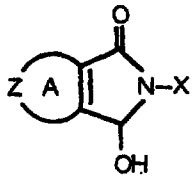
13. Verfahren zur Herstellung einer Verbindung nach Anspruch 1, oder eines Salzes derselben, das das Hydrolysieren einer Verbindung der Formel (II)



II

worin jedes der Symbole die in Anspruch 1 angeführte Bedeutung besitzt, und Q für —$COOR^4$ (R^4 ist ein Niederalkyl) oder —CN steht und nach Bedarf Verestern oder Amidieren der erhaltenen Hydrolysatverbindung umfaßt.

14. Verfahren zur Herstellung einer Verbindung nach Anspruch 1, oder eines Salzes derselben, das die Umsetzung einer Verbindung der Formel (III)



III

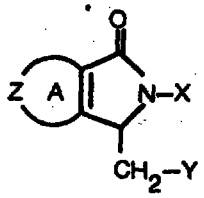
worin Z, X und A die in Anspruch 1 angeführte Bedeutung besitzen, mit einer Verbindung der Formel Ph_3P=CHY umfaßt, worin Y die in Anspruch 1 angeführte Bedeutung besitzt.

15. Pharmazeutische Zusammensetzung, die (a) als Wirkstoff eine gegen Angstzustände wirksame Menge wenigstens einer der in Anspruch 1 definierten Verbindungen oder ein physiologisch verträgliches Salz derselben und (b) pharmazeutisch verträgliche Trägermittel hierfür enthält.

* C L M S *

Patentansprüche für den Vertragsstaat: AT

1. Verfahren zur Herstellung einer Verbindung der Formel (I)

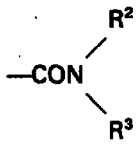


I

worin

X gegebenenfalls durch 1 bis 3 Substituenten ausgewählt aus Halogen, C_{1-4} Alkyl, C_{1-4} Alkoxy, Methylendioxy, Phenoxy, Benzyloxy, Hydroxyl, C_{2-5} Alkanoyloxy, Amino, Di-C_{1-4} Alkylamino, ω-Hydroxy-C_{1-3} Alkyl, C_{2-5} Alkanoyl, Benzoyl, Amino, Nitro, Cyano, Trifluormethyl, C_{1-4} Alkylthio, C_{2-5} Alkanoyloxy-C_{1-3} Alkyl, C_{2-5} Alkanoylamino, Methoxycarbonyl oder Äthoxycarbonyl substituiertes Aryl, Naphthyridinyl, Pyridyl oder Chinolyl ist;

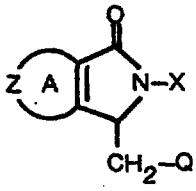
Y die Carboxylgruppe —$COOR^1$ darstellt, worin R^1 für C_{1-4} Alkyl, Phenyl C_{1-4} Alkyl oder Phenyl steht oder



bedeutet, worin R^2 und R^3 gleich oder verschieden sind und jeweils Wasserstoff, C_{1-4} Alkyl, Phenyl-C_{1-4} Alkyl, Phenyl, Thiazolyl oder Benzothiazolyl darstellen und R^2 und R^3 jeweils durch Halogen, Hydroxy, C_{1-4} Alkoxy, C_{2-5} Alkoxycarbonyl oder Di-C_{1-4} Alkylamino substituiert sein können und

R^2 und R^3 zusammen mit dem angrenzenden N-Atom eine 5- bis 7-gliedrige cyclische Aminogruppe bilden können, die ein N-, O- oder S-Atom als zweites Heteroatom zusätzlich zu dem genannten angrenzenden N-Atom enthalten kann und die 1 bis 2 Substituenten ausgewählt aus Hydroxyl, C_{1-4} Alkoxy, C_{1-4} Alkyl, C_{2-5} Alkoxycarbonyl, Phenyl-C_{1-4} Alkyl, Phenyl, Piperidino oder Pyridyl aufweisen kann;

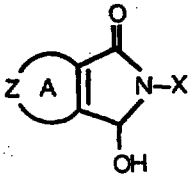
Z für —CH=CH—CH=CH—; —S—$(CH_2)_2$—S—, —N=CHCH=N— oder —$(CH_2)_4$— steht; der Ring A gegebenenfalls durch 1 oder 2 Substituenten ausgewählt aus Halogen, Nitro, Amino, C_{2-5} Alkanoylamino, C_{2-5} Alkoxycarbonyl, Carboxyl oder Carbamoyl substituiert sein kann; oder eines Salzes derselben, das die Hydrolysierung einer Verbindung der Formel (II)



II

worin jedes der Symbole die vorstehend angeführte Bedeutung besitzt und Q für —$COOR^4$ (R^4 ist ein Niederalkyl) oder —CN steht, und nach Bedarf das Verestern oder Amidieren der entstandenen Hydrolysatverbindung umfaßt.

2. Verfahren zur Herstellung einer Verbindung der in Anspruch 1 definierten Verbindung der Formel (I) oder eines Salzes derselben, umfassend die Umsetzung einer Verbindung der Formel (III)



III

worin Z, X und A die in Anspruch 1 angeführte Bedeutung besitzen, mit einer Verbindung der Formel Ph_3P=CHY, worin Y die in Anspruch 1 angeführte Bedeutung besitzt.

3. Verfahren nach Anspruch 1 oder 2, worin X für gegebenenfalls durch C_{1-4} Alkoxy oder Halogen substituiertes Phenyl oder Naphthyridinyl steht.

* C L M S *

4. Verfahren nach Anspruch 1 oder 2, worin Y —CO—NR_2R_3 darstellt.

5. Verfahren nach Anspruch 1 oder 2, worin Z —CH=CH—CH=CH— ist.

6. Verfahren nach Anspruch 4, worin Y ein cyclisches Aminocarbonyl darstellt.

7. Verfahren nach Anspruch 1 oder 2, worin X für ein durch C_{1-4} Alkoxy oder Halogen substituiertes Phenyl steht; Y ein cyclisches Aminocarbonyl bedeutet; Z —CH=CH—CH=CH— darstellt und der Ring A gegebenenfalls durch Halogen substituiert ist.

8. Verfahren nach Anspruch 1 oder 2, worin die hergestellte Verbindung 5-Chlor-2-(4-methoxyphenyl)-3-(4-methylpiperazin-1-yl)-carbonylmethylisoindolin-1-on ist.

9. Verfahren nach Anspruch 1 oder 2, worin die hergestellte Verbindung 2-(4-Methoxyphenyl)-3-piperidinocarbonylmethylisoindolin-1-on ist.

10. Verfahren nach Anspruch 1 oder 2, worin die hergestellte Verbindung 5-Chlor-2-(4-methoxyphenyl)-3-piperidinocarbonylmethylisoindolin-1-on ist.

11. Verfahren nach Anspruch 1 oder 2, worin die hergestellte Verbindung 5-Nitro-2-(4-methoxyphenyl)-3-piperidinocarbonylmethylisoindolin-1-on ist.

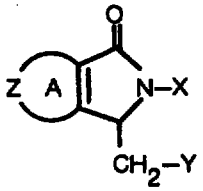
12. Verfahren nach Anspruch 1 oder 2, worin die hergestellte Verbindung 5-Chlor-2-(7-chlor-1,8-naphthyridin-2-yl)-3-piperidinocarbonylmethylisoindolin-1-on ist.

13. Verfahren nach Anspruch 1 oder 2, worin die hergestellte Verbindung 6-Chlor-2-(7-chlor-1,8-naphthyridin-2-yl)-3-piperidinocarbonylmethylisoindolin-1-on ist.

14. Pharmazeutische Zusammensetzung, die (a) als Wirkstoff eine gegen Angstzustände wirksame Menge wenigstens einer der in Anspruch 1 definierten Verbindungen der Formel (I) oder ein physiologisch verträgliches Salz derselben und (b) pharmazeutisch verträgliche Trägermittel hierfür enthält.

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

1. Composé de formule (I)

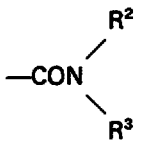


I

dans laquelle

X est un groupe aryle, naphtyridinyle, pyridyle ou quinoléyle, qui peut être éventuellement substitué par 1 à 3 halogènes, groupes C_{1-4} alkyle, C_{1-4} alkoxy, méthylènedioxy, phénoxy, benzyloxy, hydroxy, C_{2-5} alkanoyloxy, amino, di-C_{1-4} alkylamino, ω-hydroxy-C_{1-3} alkyle, C_{2-5} alkanoyle, benzoyle, amido, nitro, cyano, trifluorométhyle, C_{1-4} alkylthio, C_{2-5} alkanoyloxy-C_{1-3} alkyle, C_{2-5} alkanoylamino, méthoxycarbonyle ou éthoxycarbonyle;

Y est le groupe carboxylique —$COOR^1$ dans lequel R^1 est un C_{1-4} alkyle, phényl-C_{1-4} alkyle ou phényle, ou



dans lequel R^2 et R^3 sont identiques ou différents et représentent chacun l'hydrogène, un groupe C_{1-4} alkyle, phényl-C_{1-4} alkyle, phényle, thiazolyle ou benzothiazolyle, et R^2 et R^3 peuvent être substitués chacun par un halogène, un groupe hydroxy, C_{1-4} alkoxy, C_{2-5} alkoxycarbonyle ou di-C_{1-4} alkylamino, et

R^2 et R^3 ensemble avec l'atome d'azote adjacent peuvent former un groupe amino cyclique de 5 à 7 chaînons qui peut comporter, en plus dudit atome d'azote adjacent, un atome d'azote, d'oxygène ou de soufre comme second hétéro-atome et qui peut porter 1 ou 2 substituants hydroxy, C_{1-4} alkoxy, C_{1-4} alkyle, C_{2-5} alkoxycarbonyle, phényl-C_{1-4} alkyle, phényle, pipéridino ou pyridyle;

Z est —CH=CH—CH=CH—, —S—$(CH_2)_2$—S—, —N=CH—CH=N— ou —$(CH_2)_4$—; le cycle A peut être éventuellement substitué par 1 ou 2 substituants halogène, nitro, amino, C_{2-5} alkanoylamino, C_{2-5} alkoxycarbonyle, carboxyle ou carbamoyle; ou un sel de ce composé.

2. Composé selon la revendication 1, dans lequel X est un phényle ou naphtyridinyle qui peut être substitué par un C_{1-4} alkoxy ou un halogène.

3. Composé selon la revendication 1, dans lequel Y est —CO—NR_2R_3.

4. Composé selon la revendication 1, dans lequel Z est —CH=CH—CH=CH—.

5. Composé selon la revendication 3, dans lequel Y est un groupe aminocarbonyle cyclique.

6. Composé selon la revendication 1, dans lequel X est un phényle qui est substitué par un C_{1-4} alkoxy ou un halogène; Y est un groupe aminocarbonyle cyclique; Z est —CH=CH—CH=CH—; et le cycle A peut être substitué par un halogène.

* C L M S *

7. Composé selon la revendication 1, qui est la 5-chloro-2-(4-méthoxyphényl)-3-(4-méthylpipérazine-1-yl)-carbonylméthylisoindolin-1-one.

8. Composé selon la revendication 1, qui est la 2-(4-méthoxyphényl)-3-pipéridinocarbonylméthylisoindolin-1-one.

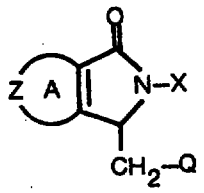
9. Composé selon la revendication 1, qui est la 5-chloro-2-(4-méthoxyphényl)-3-pipéridinocarbonylméthylisoindolin-1-one.

10. Composé selon la revendication 1, qui est la 5-nitro-2-(4-méthoxyphényl)-3-pipéridinocarbonylméthylisoindolin-1-one.

11. Composé selon la revendication 1, qui est la 5-chloro-2-(7-chloro-1,8-naphtyridin-2-yl)-3-pipéridinocarbonylméthylisoindolin-1-one.

12. Composé selon la revendication 1, qui est la 6-chloro-2-(7-chloro-1,8-naphtyridin-2-yl)-3-pipéridinocarbonylméthylisoindolin-1-one.

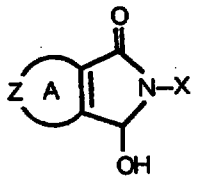
13. Procédé de préparation d'un composé selon la revendication 1 ou d'un sel de celui-ci, qui comprend l'hydrolyse d'un composé de formule (II)



II

dans laquelle chaque symbole est tel que défini à la revendication 1 et Q est —$COOR^4$ (R^4 étant un alkyle inférieur) ou —CN et, si nécessaire, l'estérification ou l'amidation du composé résultant de l'hydrolyse.

14. Procédé de préparation d'un composé selon la revendication 1 ou d'un sel de celui-ci, qui comprend la réaction d'un composé de formule (III)



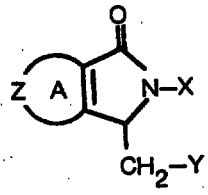
III

dans laquelle Z, X et A sont tels que défini à la revendication 1, avec un composé de formule $Ph_3P{=}CHY$, dans laquelle Y est telle que définie à la revendication 1.

15. Composition pharmaceutique qui comprend (a) comme substance active, une quantité efficace contre l'anxiété d'au moins un composé selon la revendication 1 ou d'un sel physiologiquement acceptable de celui-ci et (b) des excipients pharmaceutiquement acceptables pour celui-ci.

Revendications pour l'Etat contractant: AT

1. Procédé de préparation d'un composé de formule (I)



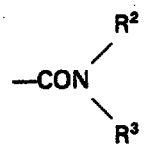
I

dans laquelle

X est un groupe aryle, naphtyridinyle, pyridyle ou quinoléyle, qui peut être éventuellement substitué par 1 à 3 halogènes, groupes C_{1-4} alkyle, C_{1-4} alkoxy, méthylènedioxy, phénoxy, benzyloxy, hydroxy, C_{2-5} alkanoyloxy, amino, di-C_{1-4} alkylamino, ω-hydroxy-C_{1-3} alkyle, C_{2-5} alkanoyle, benzoyle, amido, nitro, cyano, trifluorométhyle, C_{1-4} alkylthio, C_{2-5} alkanoyloxy-C_{1-3} alkyle, C_{2-5} alkanoylamino, méthoxycarbonyle ou éthoxycarbonyle;

Y est le groupe carboxylique —$COOR^1$ dans lequel R^1 est un C_{1-4} alkyle, phényl-C_{1-4} alkyle ou phényle, ou

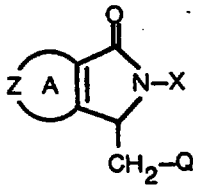
* C L M S *



dans lequel R^2 et R^3 sont identiques ou différents et représentent chacun l'hydrogène, un groupe C_{1-4} alkyle, phényl-C_{1-4} alkyle, phényle, thiazolyle ou benzothiazolyle, et R^2 et R^3 peuvent être substitués chacun par un halogène, un groupe hydroxy, C_{1-4} alkoxy, C_{2-5} alkoxycarbonyle ou di-C_{1-4} alkylamino, et

R^2 et R^3 ensemble avec l'atome d'azote adjacent peuvent former un groupe amino cyclique de 5 à 7 chaînons qui peut comporter, en plus dudit atome d'azote adjacent, un atome d'azote, d'oxygène ou de soufre comme second hétéro-atome et qui peut porter 1 ou 2 substituants hydroxy, C_{1-4} alkoxy, C_{1-4} alkyle, C_{2-5} alkoxycarbonyle, phényl-C_{1-4} alkyle, phényle, pipéridino ou pyridyle;

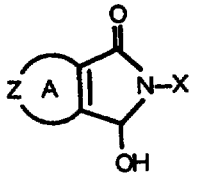
Z est —CH=CH—CH=CH—, —S—$(CH_2)_2$—S—, —N=CH—CH=N— ou —$(CH_2)_4$—; le cycle A peut être éventuellement substitué par 1 ou 2 substituants halogène, nitro, amino, C_{2-5} alkanoylamino, C_{2-5} alkoxycarbonyle, carboxyle ou carbamoyle; ou d'un sel de celui-ci, qui comprend l'hydrolyse d'un composé de formule (II)



II

dans laquelle chaque symbole est tel que défini à la revendication 1 et Q est —$COOR^4$ (R^4 étant un alkyle inférieur) ou —CN et, si nécessaire, l'estérification ou l'amidation du composé résultant de l'hydrolyse.

2. Procédé de préparation d'un composé de formule (I) telle que définie à la revendication 1 ou d'un sel de celui-ci, qui comprend la réaction d'un composé de formule (III)



III

dans laquelle Z, X et A sont tels que définis à la revendication 1, avec un composé de formule Ph_3P=CHY, dans laquelle Y est telle que définie à la revendication 1.

3. Procédé selon la revendication 1 ou 2, dans lequel X est un phényle ou naphtyridinyle qui peut être substitué par un C_{1-4} alkoxy ou un halogène.

4. Procédé selon la revendication 1 ou 2, dans lequel Y est —CO—NR_2R_3.

5. Procédé selon la revendication 1 ou 2, dans lequel Z est —CH=CH—CH=CH—.

6. Procédé selon la revendication 4, dans lequel Y est un groupe aminocarbonyle cyclique.

7. Procédé selon la revendication 1 ou 2, dans lequel X est un phényle qui est substitué par un C_{1-4} alkoxy ou un halogène; Y est un groupe aminocarbonyle cyclique; Z est —CH=CH—CH=CH—; et le cycle A peut être substitué par un halogène.

8. Procédé selon la revendication 1 ou 2, dans lequel le composé obtenu est la 5-chloro-2-(4-méthoxyphényl)-3-(4-méthylpipérazine-1-yl)-carbonylméthylisoindolin-1-one.

9. Procédé selon la revendication 1 ou 2, dans lequel le composé obtenu est la 2-(4-méthoxyphényl)-3-pipéridinocarbonylméthylisoindolin-1-one.

10. Procédé selon la revendication 1 ou 2, dans lequel le composé obtenu est la 5-chloro-2-(4-méthoxyphényl)-3-pipéridinocarbonylméthylisoindolin-1-one.

11. Procédé selon la revendication 1 ou 2, dans lequel le composé obtenu est la 5-nitro-2-(4-méthoxyphényl)-3-pipéridinocarbonylméthylisoindolin-1-one.

12. Procédé selon la revendication 1 ou 2, dans lequel le composé obtenu est la 5-chloro-2-(7-chloro-1,8-naphtyridin-2-yl)-3-pipéridinocarbonylméthylisoindolin-1-one.

13. Procédé selon la revendication 1 ou 2, dans lequel le composé obtenu est la 6-chloro-2-(7-chloro-1,8-naphtyridin-2-yl)-3-pipéridinocarbonylméthylisoindolin-1-one.

14. Composition pharmaceutique qui comprend (a) comme substance active, une quantité efficace contre l'anxiété d'au moins un composé répondant à la formule (I) telle que définie à la revendication 1 ou d'un sel physiologiquement acceptable de celui-ci et (b) des excipients pharmaceutiquement acceptables pour celui-ci.

* C L M S *