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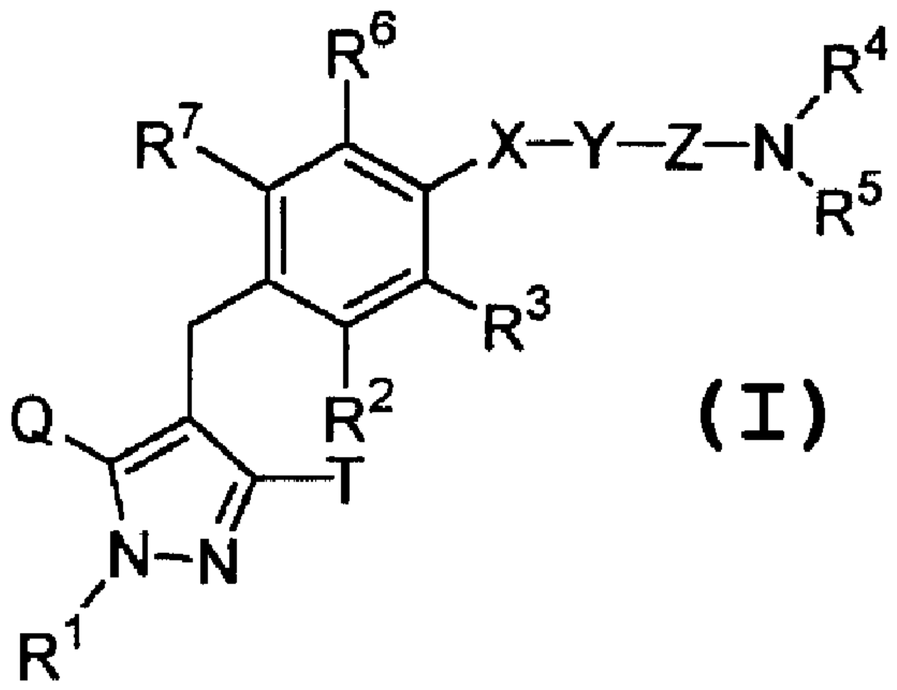
(54) Titre : DERIVE DE PYRAZOLE, COMPOSITION MEDICINALE CONTENANT CE DERIVE, UTILISATION THERAPEUTIQUE DE CEUX-CI ET INTERMEDIAIRE POUR LA PRODUCTION DE CETTE COMPOSITION

(54) Title: PYRAZOLE DERIVATIVE, MEDICINAL COMPOSITION CONTAINING THE SAME, MEDICINAL USE THEREOF, AND INTERMEDIATE FOR PRODUCTION THEREOF



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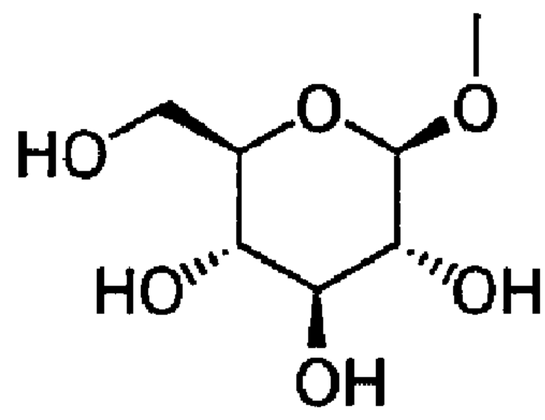

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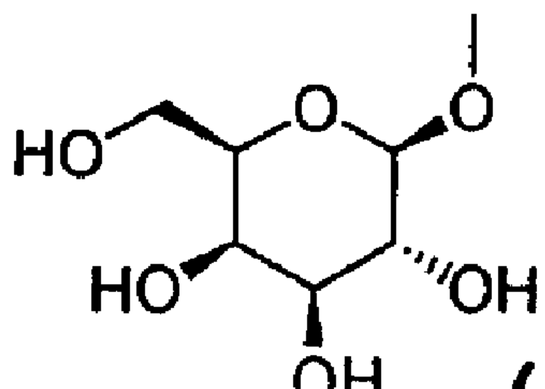

(III)

(57) Abrégé/Abstract:
The present invention provides pyrazole derivatives represented by the general formula: (see formula I) wherein R^1 represents H, an optionally substituted C_{1-6} alkyl group etc.; one of Q and T represents a group represented by the general formula: (see formula II) or a group represented by the general formula: (see formula III) while the other represents an optionally substituted C_{1-6} alkyl group etc.; R^2 represents H, a halogen atom, OH, an optionally substituted C_{1-6} alkyl group etc.; X represents a single bond, O or S; Y represents a single bond, a C_{1-6} alkylene group etc. ; Z represents CO or SO_2; R^4 and R^5 represent H, an optionally substituted C_{1-6} alkyl group etc.; and R^3, R^6 and R^7 represent H, a halogen atom etc., pharmaceutically acceptable salts thereof or

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(13) **C**

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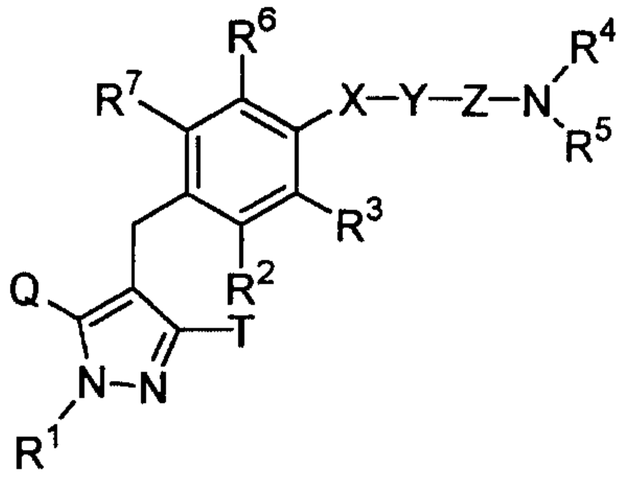
(57) **Abrégé(suite)/Abstract(continued)**:
prodrugs thereof, which exhibit an excellent inhibitory activity in human SGLT1 and are useful as agents for the prevention or treatment of a disease associated with hyperglycemia such as diabetes, diabetic complications or obesity, and pharmaceutical compositions comprising the same, pharmaceutical uses thereof, and intermediates for production thereof.

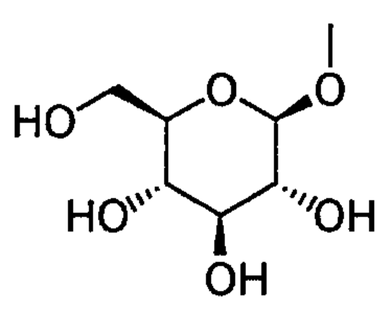
ABSTRACT

The present invention provides pyrazole derivatives represented by the general formula:

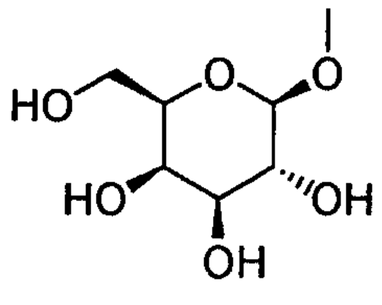


(I)

wherein R^1 represents H, an optionally substituted C_{1-6} alkyl group etc.; one of Q and T represents a group represented by the general formula:



or a group represented by the general formula:



while the other represents an optionally substituted C_{1-6} alkyl group etc.; R^2 represents H, a halogen atom, OH, an optionally substituted C_{1-6} alkyl group etc.; X represents a single bond, O or S; Y represents a single bond, a C_{1-6} alkylene group etc.; Z represents CO or SO_2; R^4 and R^5 represent H, an optionally substituted C_{1-6} alkyl group etc.; and R^3, R^6 and R^7 represent

H, a halogen atom etc., pharmaceutically acceptable salts thereof or prodrugs thereof, which exhibit an excellent inhibitory activity in human SGLT1 and are useful as agents for the prevention or treatment of a disease associated with hyperglycemia such as diabetes, diabetic complications or obesity, and pharmaceutical compositions comprising the same, pharmaceutical uses thereof, and intermediates for production thereof.

DESCRIPTION

PYRAZOLE DERIVATIVE, MEDICINAL COMPOSITION CONTAINING THE SAME, MEDICINAL USE THEREOF, AND INTERMEDIATE FOR PRODUCTION THEREOF

Technical Field

The present invention relates to pyrazole derivatives, pharmaceutically acceptable salts thereof or prodrugs thereof which are useful as medicaments, pharmaceutical compositions comprising the same, pharmaceutical uses thereof and intermediates for production thereof.

More particularly, the present invention relates to pyrazole derivatives having an inhibitory activity in human SGLT1, pharmaceutically acceptable salts thereof or prodrugs thereof which are useful as agents for the prevention or treatment of a disease associated with hyperglycemia such as diabetes, impaired glucose tolerance, impaired fasting glycemia, diabetic complications or obesity, pharmaceutical compositions comprising the same, pharmaceutical uses thereof and intermediates for production thereof.

Background Art

Diabetes is one of lifestyle-related diseases with the background of change of eating habit and lack of exercise. Hence, diet and exercise therapies are performed in patients with diabetes. Furthermore, when its sufficient control and continuous performance are difficult, drug treatment is simultaneously performed. In addition, it has been confirmed

by large-scale clinical trial that it is necessary to practice a long-term control of blood sugar level strictly so as to prevent patients with diabetes from occuring and advancing diabetic complications by recieving treatment (see the following References 1 and 2). Furthermore, many epidemiologic studies on impaired glucose tolerance and macroangiopathy show that impaired glucose tolerance as the boundary type is also a risk factor in macroangiopathy as well as diabetes. Thus, needs to improve postprandial hyperglycemia have been focused (see the following Reference 3).

In recent years, development of various antidiabetic agents has been progressing with the background of a rapid increase of patients with diabetes. For example, a-glucosidase inhibitors, which delay carbohydrate digestion and absorption at the small intestine, are used to improve postprandial hyperglycemia. It has been also reported that acarbose, one of a-glucosidase inhibitors, has an effect of preventing or delaying the incidence of diabetes by applying to patients with impaired glucose tolerance (see the following Reference 4). However, since a-glucosidase inhibitors do not affect elevated glucose levels by ingesting a monosaccharide of glucose (see the following Reference 5), with recently changing compositions of sugars in meals, it has been desired to develop agents which exert a wider range of activities inhibiting carbohydrate absorption.

In the meantime, it has been known that SGLT1, sodium-dependent glucose transporter 1, exists in the small

intestine which controls carbohydrate absorption. It has been also reported that insufficiency of glucose and galactose absorption arises in patients with dysfunction due to congenital abnormalities of human SGLT1 (see the following References 6-8). In addition, it has been confirmed that SGLT1 is involved in glucose and galactose absorption (see the following References 9 and 10).

Furthermore, it is confirmed that mRNA and protein of SGLT1 increase and absorption of glucoses are accelerated in OLETF rats and rats with streptozotocin-induced diabetic symptoms (see the following References 11 and 12). Generally in patients with diabetes, carbohydrate digestion and absorption are increased. For example, it is confirmed that mRNA and protein of SGLT1 are highly increased in the human small intestine (see the following Reference 13).

Therefore, blocking a human SGLT1 activity inhibits absorption of carbohydrates such as glucose at the small intestine, subsequently can prevent increase of blood sugar level. Especially, it is considered that delaying glucose absorption based on the above mentioned mechanism is effective to normalize postprandial hyperglycemia. In addition, since increase of SGLT1 in the small intestine is thought to contribute to increased carbohydrate absorption, fast development of agents, which have a potent inhibitory activity in human SGLT1, has been desired for the prevention or treatment of diabetes.

Reference 1: The Diabetes Control and Complications Trial Research Group, N. Engl. J. Med., 1993.9, Vol.329, No.14,

pp.977-986;

Reference 2: UK Prospective Diabetes Study Group, Lancet, 1998.9, Vol.352, No.9131, pp.837-853;

Reference 3: Makoto, TOMINAGA, Endocrinology & Diabetology, 2001.11, Vol.13, No.5, pp.534-542;

Reference 4: Jean-Louis Chiasson and 5 persons, Lancet, 2002.6, Vol.359, No.9323, pp.2072-2077;

Reference 5: Hiroyuki, ODAKA and 3 persons, Journal of Japanese Society of Nutrition and Food Science, 1992, Vol.45, No.1, pp.27-31;

Reference 6: Tadao, BABA and 1 person, Supplementary volume of Nippon Rinsho, Ryoikibetsu Shokogun, 1998, No.19, pp.552-554;

Reference 7: Michihiro, KASAHARA and 2 persons, Saishin Igaku, 1996.1, Vol.51, No.1, pp.84-90;

Reference 8: Tomofusa, TSUCHIYA and 1 person, Nippon Rinsho, 1997.8, Vol.55, No.8, pp.2131-2139;

Reference 9: Yoshikatsu, KANAI, Kidney and Dialysis, 1998.12, Vol.45, extra edition, pp.232-237;

Reference 10: E. Turk and 4 persons, Nature, 1991.3, Vol.350, pp.354-356;

Reference 11: Y. Fujita and 5 persons, Diabetologia, 1998, Vol.41, pp.1459-1466;

Reference 12: J. Dyer and 5 persons, Biochemical Society Transactions, 1997, Vol.25, p.479S;

Reference 13: J. Dyer and 4 persons, American Journal of Physiology, 2002.2, Vol.282, No.2, pp.G241-G248

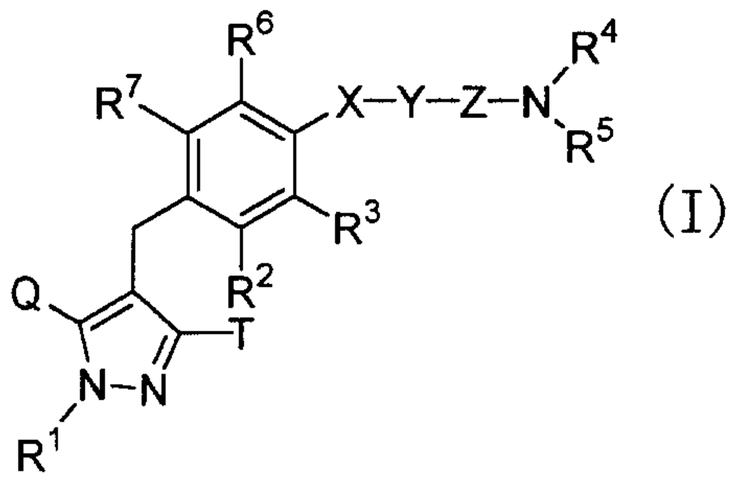
Disclosure of the Invention

The present inventors have studied earnestly to find compounds having an inhibitory activity in human SGLT1. As a result, it was found that certain pyrazole derivatives represented by the following general formula (I) show an inhibitory activity in human SGLT1 at the small intestine and exert an excellent inhibitory activity in increase of blood glucose level as shown below, thereby forming the basis of the present invention.

The present invention is to provide novel pyrazole derivatives which exert an excellent inhibitory activity of blood glucose level increase by showing an inhibitory activity in human SGLT1 and inhibiting absorption of carbohydrate such as glucose at the small intestine, pharmaceutically acceptable salts thereof or prodrugs thereof, and to provide pharmaceutical compositions comprising the same, pharmaceutical uses thereof and intermediates for production thereof.

This is, the present invention relates to

[1] a pyrazole derivative represented by the general formula:

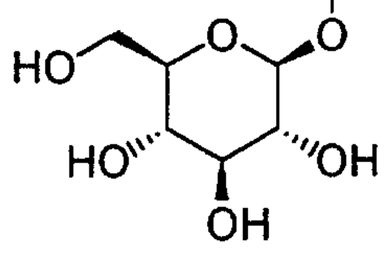


(I)

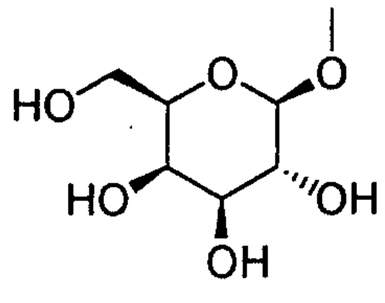
wherein

R^1 represents a hydrogen atom, a C_{1-6} alkyl group, a C_{2-6} alkenyl group, a hydroxy(C_{2-6} alkyl) group, a C_{3-7} cycloalkyl group, a C_{3-7} cycloalkyl-substituted (C_{1-6} alkyl) group, an aryl group which may have the same or different 1 to 3 substituents selected from the group consisting of a halogen atom, a hydroxy group, an amino group, a C_{1-6} alkyl group and a C_{1-6} alkoxy group, or an aryl(C_{1-6} alkyl) group which may have the same or different 1 to 3 substituents selected from the group consisting of a halogen atom, a hydroxy group, an amino group, a C_{1-6} alkyl group and a C_{1-6} alkoxy group on the ring;

one of Q and T represents a group represented by the formula:



or a group represented by the formula:



while the other represents a C_{1-6} alkyl group, a halo(C_{1-6} alkyl) group, a C_{1-6} alkoxy-substituted (C_{1-6} alkyl) group or a C_{3-7} cycloalkyl group;

R^2 represents a hydrogen atom, a halogen atom, a hydroxy group, a C_{1-6} alkyl group, a C_{1-6} alkoxy group, a C_{1-6} alkylthio group, a halo(C_{1-6} alkyl) group, a halo(C_{1-6} alkoxy) group, a C_{1-6} alkoxy-substituted (C_{1-6} alkoxy) group, a C_{3-7} cycloalkyl-substituted (C_{2-6} alkoxy) group or a group of the general formula:

-A-R^8 in which A represents a single bond, an oxygen atom, a methylene group, an ethylene group, -OCH_2- or -CH_2O-; and R^8 represents a C_{3-7} cycloalkyl group, a C_{2-6} heterocycloalkyl group, an aryl group which may have the same or different 1 to 3 substituents selected from the group consisting of a halogen atom, a hydroxy group, an amino group, a C_{1-6} alkyl group, a C_{1-6} alkoxy group, a C_{2-6} alkenyloxy group, a halo(C_{1-6} alkyl) group, a hydroxy(C_{1-6} alkyl) group, a carboxy group, a C_{2-7} alkoxycarbonyl group, a cyano group and a nitro group, or a heteroaryl group which may have a substituent selected from the group consisting of a halogen atom and a C_{1-6} alkyl group;

X represents a single bond, an oxygen atom or a sulfur atom;

Y represents a single bond, a C_{1-6} alkylene group or a C_{2-6} alkenylene group with the proviso that X is a single bond when Y is a single bond;

Z represents a carbonyl group or a sulfonyl group;

R^4 and R^5 are the same or different, and each represents a hydrogen atom or a C_{1-6} alkyl group which may have the same or different 1 to 3 groups selected from the following substituent group (i), or they bind together with the neighboring nitrogen atom to form a C_{2-6} cyclic amino group which may have a substituent selected from the group consisting of a C_{1-6} alkyl group and a hydroxy(C_{1-6} alkyl) group;

R^3, R^6 and R^7 are the same or different, and each represents a hydrogen atom, a halogen atom, a C_{1-6} alkyl group or a C_{1-6} alkoxy group; and

substituent group (i) consists of a hydroxy group, an amino group, a mono or di(C_{1-6} alkyl)amino group, a mono or di[hydroxy(C_{1-6} alkyl)]amino group, an ureido group, a sulfamide group, a mono or di(C_{1-6} alkyl)ureido group, a mono or di(C_{1-6} alkyl)sulfamide group, a C_{2-7} acylamino group, a C_{1-6} alkylsulfonylamino group, a group of the general formula: $-CON(R^9)R^{10}$ in which R^9 and R^{10} are the same or different, and each represents a hydrogen atom or a C_{1-6} alkyl group which may have the same or different 1 to 3 substituents selected from the group consisting of a hydroxy group, an amino group, a mono or di(C_{1-6} alkyl)amino group, a mono or di[hydroxy(C_{1-6} alkyl)]amino group, an ureido group, a mono or di(C_{1-6} alkyl)ureido group, a C_{2-7} acylamino group, a C_{1-6} alkylsulfonylamino group and a carbamoyl group, or they bind together with the neighboring nitrogen atom to form a C_{2-6} cyclic amino group which may have a substituent selected from the group consisting of a C_{1-6} alkyl group and a hydroxy(C_{1-6} alkyl) group, a C_{3-7} cycloalkyl group, a C_{2-6} heterocycloalkyl group, an aryl group which may have the same or different 1 to 3 substituents selected from the group consisting of a halogen atom, a hydroxy group, an amino group, a C_{1-6} alkyl group and a C_{1-6} alkoxy group, a heteroaryl group which may have a substituent selected from the group consisting of a halogen atom and a C_{1-6} alkyl group, a C_{2-6} cyclic amino group which may have a substituent selected from the group consisting of a C_{1-6} alkyl group and a hydroxy(C_{1-6} alkyl) group, and a C_{1-4} aromatic cyclic amino group which may have a C_{1-6} alkyl group as a substituent,

or a pharmaceutically acceptable salt thereof;

[2] a pyrazole derivative described in the above [1] wherein Y represents a C_{1-6} alkylene group or a C_{2-6} alkenylene group; one of R^4 and R^5 represents a C_{1-6} alkyl group which has the same or different 1 to 3 groups selected from the following substituent group (i), the other represents a hydrogen atom or a C_{1-6} alkyl group which may have the same or different 1 to 3 groups selected from the following substituent group (i); and substituent group (i) consists of a hydroxy group, an amino group, a mono or di(C_{1-6} alkyl)amino group, a mono or di[hydroxy(C_{1-6} alkyl)]amino group, an ureido group, a sulfamide group, a mono or di(C_{1-6} alkyl)ureido group, a mono or di(C_{1-6} alkyl)sulfamide group, a C_{2-7} acylamino group, a C_{1-6} alkylsulfonylamino group, a group of the general formula:

$-CON(R^9)R^{10}$ in which R^9 and R^{10} are the same or different, and each represents a hydrogen atom or a C_{1-6} alkyl group which may have the same or different 1 to 3 substituents selected from the group consisting of a hydroxy group, an amino group, a mono or di(C_{1-6} alkyl)amino group, a mono or di[hydroxy(C_{1-6} alkyl)]amino group, an ureido group, a mono or di(C_{1-6} alkyl)-ureido group, a C_{2-7} acylamino group, a C_{1-6} alkylsulfonylamino group and a carbamoyl group, or they bind together with the neighboring nitrogen atom to form a C_{2-6} cyclic amino group which may have a substituent selected from the group consisting of a C_{1-6} alkyl group and a hydroxy(C_{1-6} alkyl) group, a C_{3-7} cycloalkyl group, a C_{2-6} heterocycloalkyl group, an aryl group which may have the same or different 1 to 3 substituents selected

from the group consisting of a halogen atom, a hydroxy group, an amino group, a C_{1-6} alkyl group and a C_{1-6} alkoxy group, a heteroaryl group which may have a substituent selected from the group consisting of a halogen atom and a C_{1-6} alkyl group, a C_{2-6} cyclic amino group which may have a substituent selected from the group consisting of a C_{1-6} alkyl group and a hydroxy(C_{1-6} alkyl) group, and a C_{1-4} aromatic cyclic amino group which may have a C_{1-6} alkyl group as a substituent, or a pharmaceutically acceptable salt thereof;

[3] a pyrazole derivative described in the above [2] wherein one of R^4 and R^5 represents a C_{1-6} alkyl group which has a group selected from the following substituent group (iA), the other represents a hydrogen atom; and substituent group (iA) is a group of the general formula: $-CON(R^{9A})R^{10A}$ in which R^{9A} and R^{10A} bind together with the neighboring nitrogen atom to form a C_{2-6} cyclic amino group which may have a substituent selected from the group consisting of a C_{1-6} alkyl group and a hydroxy(C_{1-6} alkyl) group, or a pharmaceutically acceptable salt thereof;

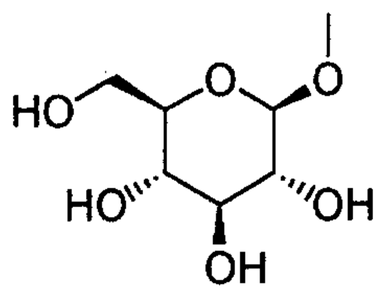
[4] a pyrazole derivative described in any one of the above [1]-[3] wherein X represents a single bond; and Y represents a trimethylene group or a 1-propenylene group, or a pharmaceutically acceptable salt thereof;

[5] a pyrazole derivative described in any one of the above [1]-[3] wherein X represents an oxygen atom; and Y represents an ethylene group or a trimethylene group, or a pharmaceutically acceptable salt thereof;

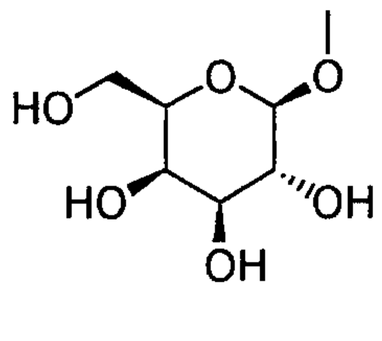
[6] a pyrazole derivative described in the above [1] wherein X represents a single bond; Y represents a single bond; one of R^4 and R^5 represents a C_{1-6} alkyl group which has the same or different 1 to 3 groups selected from the following substituent group (iB), the other represents a hydrogen atom or a C_{1-6} alkyl group which may have the same or different 1 to 3 groups selected from the following substituent group (iB); and substituent group (iB) consists of an ureido group, a sulfamide group, a mono or di(C_{1-6} alkyl)ureido group, a mono or di(C_{1-6} alkyl)sulfamide group, a C_{1-6} alkylsulfonylamino group, a group of the general formula: -CON(R^{9B})R^{10B} in which one of R^{9B} and R^{10B} represents a C_{1-6} alkyl group which has the same or different 1 to 3 substituents selected from the group consisting of a hydroxy group, an amino group, a mono or di(C_{1-6} alkyl)amino group, a mono or di[hydroxy(C_{1-6} alkyl)]amino group, an ureido group, a mono or di(C_{1-6} alkyl)ureido group, a C_{2-7} acylamino group, a C_{1-6} alkylsulfonylamino group and a carbamoyl group, the other represents a hydrogen atom, a C_{1-6} alkyl group which may have the same or different 1 to 3 substituents selected from the group consisting of a hydroxy group, an amino group, a mono or di(C_{1-6} alkyl)amino group, a mono or di[hydroxy(C_{1-6} alkyl)]amino group, an ureido group, a mono or di(C_{1-6} alkyl)-ureido group, a C_{2-7} acylamino group, a C_{1-6} alkylsulfonylamino group and a carbamoyl group, or they bind together with the neighboring nitrogen atom to form a C_{2-6} cyclic amino group which may have a substituent selected from the group consisting of a C_{1-6} alkyl group and a hydroxy(C_{1-6} alkyl) group, a C_{3-7}

cycloalkyl group, a C_{2-6} heterocycloalkyl group, an aryl group which may have the same or different 1 to 3 substituents selected from the group consisting of a halogen atom, a hydroxy group, an amino group, a C_{1-6} alkyl group and a C_{1-6} alkoxy group, a heteroaryl group which may have a substituent selected from the group consisting of a halogen atom and a C_{1-6} alkyl group, a C_{2-6} cyclic amino group which may have a substituent selected from the group consisting of a C_{1-6} alkyl group and a hydroxy(C_{1-6} alkyl) group, and a C_{1-4} aromatic cyclic amino group which may have a C_{1-6} alkyl group as a substituent, or a pharmaceutically acceptable salt thereof;

[7] a pyrazole derivative described in any one of the above [1]-[6] wherein R^1 represents a hydrogen atom or a hydroxy(C_{2-6} alkyl) group; T represents a group represented by the formula:



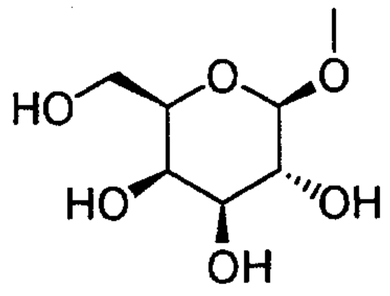
or a group represented by the formula:



Q represents a C_{1-6} alkyl group or a halo(C_{1-6} alkyl) group; and R^3, R^6 and R^7 represent a hydrogen atom, or a pharmaceutically acceptable salt thereof;

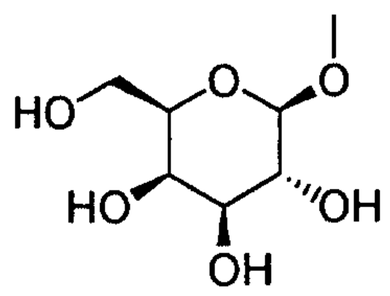
[8] a pyrazole derivative described in any one of the above [1]-[6] wherein one of Q and T represents a group represented

by the formula:



the other represents a C_{1-6} alkyl group, a halo(C_{1-6} alkyl) group, a C_{1-6} alkoxy-substituted (C_{1-6} alkyl) group or a C_{3-7} cycloalkyl group, or a pharmaceutically acceptable salt thereof;

[9] a pyrazole derivative described in the above [7] or [8] wherein T represents a group represented by the formula:

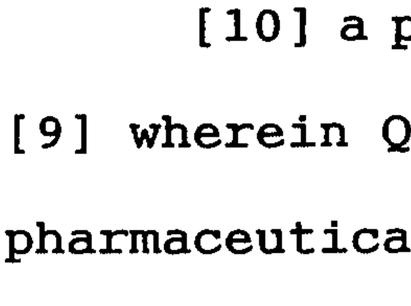


or a pharmaceutically acceptable salt thereof;

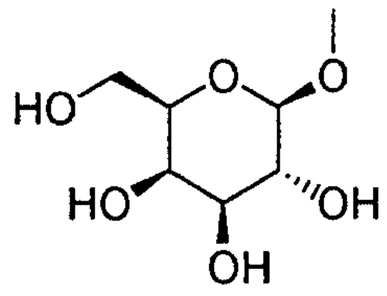
[10] a pyrazole derivative described in the above [7] or [9] wherein Q represents an isopropyl group, or a pharmaceutically acceptable salt thereof;

[11] a prodrug of a pyrazole derivative described in any one of the above [1]-[10] or a pharmaceutically acceptable salt thereof;

[12] a prodrug described in the above [11] wherein T represents a group represented by the formula:



or a group represented by the formula:



in which the hydroxy group at the 4-position is substituted by a glucopyranosyl group or a galactopyranosyl group, or the hydroxy group at the 6-position is substituted by a glucopyranosyl group, a galactopyranosyl group, a C_{2-7} acyl group, a C_{1-6} alkoxy-substituted (C_{2-7} acyl) group, a C_{2-7} alkoxy-carbonyl-substituted (C_{2-7} acyl) group, a C_{2-7} alkoxycarbonyl group, an aryl(C_{2-7} alkoxycarbonyl) group or a C_{1-6} alkoxy-substituted (C_{2-7} alkoxycarbonyl) group;

[13] a pyrazole derivative described in the above [1] which is a compound selected from the following group:

4-[(4-{3-[1-carbamoyl-1-(methyl)ethylcarbamoyl]propyl}-2-methylphenyl)methyl]-3-(β-D-glucopyranosyloxy)-5-isopropyl-1*H*-pyrazole;

3-(β-D-galactopyranosyloxy)-4-[(4-{3-[1-{[4-(2-hydroxy-ethyl)piperazin-1-yl]carbonyl}-1-(methyl)ethylcarbamoyl]-propyl}phenyl)methyl]-5-isopropyl-1*H*-pyrazole;

3-(β-D-galactopyranosyloxy)-5-isopropyl-4-{[4-(3-{1-[2-(dimethylamino)ethylcarbamoyl]-1-(methyl)ethylcarbamoyl}-propyl)phenyl]methyl}-1*H*-pyrazole;

4-[(4-{3-[1-(2-aminoethylcarbamoyl)-1-(methyl)ethyl-carbamoyl]propyl}phenyl)methyl]-3-(β-D-galactopyranosyl-oxy)-5-isopropyl-1*H*-pyrazole;

3-(β-D-galactopyranosyloxy)-5-isopropyl-4-{[4-(3-{1-[(piperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}-

propyl)phenyl]methyl}-1*H*-pyrazole;

3-(β-D-glucopyranosyloxy)-4-[(4-{3-[1-{[4-(2-hydroxyethyl)-piperazin-1-yl]carbonyl}-1-(methyl)ethylcarbamoyl]-propyl}-2-methylphenyl)methyl]-5-isopropyl-1*H*-pyrazole;

3-(β-D-galactopyranosyloxy)-5-isopropyl-4-{[4-(3-{1-[(4-methylpiperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}-propyl)phenyl]methyl}-1*H*-pyrazole;

3-(β-D-galactopyranosyloxy)-5-isopropyl-4-{[4-(3-{1-[(4-isopropylpiperazin-1-yl)carbonyl]-1-(methyl)ethyl-carbamoyl}propyl)phenyl]methyl}-1*H*-pyrazole;

3-(β-D-glucopyranosyloxy)-4-[(4-{3-[(*S*)-2-hydroxy-1-(methyl)ethylcarbamoyl]propyl}phenyl)methyl]-5-isopropyl-1*H*-pyrazole;

3-(β-D-glucopyranosyloxy)-4-[(4-{(1*E*)-3-[(*S*)-2-hydroxy-1-(methyl)ethylcarbamoyl]prop-1-enyl}phenyl)methyl]-5-isopropyl-1*H*-pyrazole;

3-(β-D-glucopyranosyloxy)-5-isopropyl-4-{[4-(2-{1-[(4-methylpiperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}-ethoxy)-2-methylphenyl]methyl}-1*H*-pyrazole;

3-(β-D-glucopyranosyloxy)-4-[(4-{2-[2-hydroxy-1,1-di-(methyl)ethylcarbamoyl]ethoxy}-2-methylphenyl)methyl]-5-isopropyl-1*H*-pyrazole;

3-(β-D-glucopyranosyloxy)-4-[(4-{2-[1-{[4-(2-hydroxyethyl)-piperazin-1-yl]carbonyl}-1-(methyl)ethylcarbamoyl]ethoxy}-2-methylphenyl)methyl]-5-isopropyl-1*H*-pyrazole;

3-(β-D-glucopyranosyloxy)-5-isopropyl-4-{[4-(2-{1-[(piperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}-

ethoxy)-2-methylphenyl]methyl}-1*H*-pyrazole;

3-(β-D-glucopyranosyloxy)-5-isopropyl-4-{[4-(3-{1-[(piperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}-propyl)-2-methylphenyl]methyl}-1*H*-pyrazole;

3-(β-D-glucopyranosyloxy)-5-isopropyl-4-{[4-(3-{1-[(piperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}-propoxy)-2-methylphenyl]methyl}-1*H*-pyrazole;

3-(β-D-glucopyranosyloxy)-4-[(4-{3-[1-{[4-(2-hydroxyethyl)-piperazin-1-yl]carbonyl}-1-(methyl)ethylcarbamoyl]propoxy}-2-methylphenyl)methyl]-5-isopropyl-1*H*-pyrazole;

3-(β-D-glucopyranosyloxy)-5-isopropyl-4-{[4-(3-{1-[(4-methylpiperazin-1-yl)carbonyl]-1-(methyl)ethyl-carbamoyl}propoxy)-2-methylphenyl]methyl}-1*H*-pyrazole;

3-(β-D-galactopyranosyloxy)-1-(3-hydroxypropyl)-5-isopropyl-4-{[4-(3-{1-[(piperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}propyl)phenyl]methyl}-1*H*-pyrazole;

3-(β-D-galactopyranosyloxy)-5-isopropyl-4-{[4-(3-{1-[(piperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}-propoxy)-2-methylphenyl]methyl}-1*H*-pyrazole;

4-{[2-fluoro-4-(3-{1-[(piperazin-1-yl)carbonyl]-1-(methyl)-ethylcarbamoyl}propyl)phenyl]methyl}-3-(β-D-galacto-pyranosyloxy)-5-isopropyl-1*H*-pyrazole;

4-{[2-chloro-4-(3-{1-[(piperazin-1-yl)carbonyl]-1-(methyl)-ethylcarbamoyl}propyl)phenyl]methyl}-3-(β-D-glucopyranosyl-oxy)-5-isopropyl-1*H*-pyrazole, and

pharmaceutically acceptable salts thereof;

[14] a pyrazole derivative described in the above [13]

which is a compound selected from the following group:

3-(β-D-galactopyranosyloxy)-4-[(4-{3-[1-{[4-(2-hydroxy-ethyl)piperazin-1-yl]carbonyl}-1-(methyl)ethylcarbamoyl]-propyl}phenyl)methyl]-5-isopropyl-1*H*-pyrazole;

3-(β-D-galactopyranosyloxy)-5-isopropyl-4-{[4-(3-{1-[(piperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}-propyl)phenyl]methyl}-1*H*-pyrazole;

3-(β-D-glucopyranosyloxy)-4-[(4-{3-[1-{[4-(2-hydroxyethyl)-piperazin-1-yl]carbonyl}-1-(methyl)ethylcarbamoyl]-propyl}-2-methylphenyl)methyl]-5-isopropyl-1*H*-pyrazole;

3-(β-D-galactopyranosyloxy)-5-isopropyl-4-{[4-(3-{1-[(4-methylpiperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}-propyl)phenyl]methyl}-1*H*-pyrazole;

3-(β-D-glucopyranosyloxy)-5-isopropyl-4-{[4-(2-{1-[(4-methylpiperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}-ethoxy)-2-methylphenyl]methyl}-1*H*-pyrazole;

3-(β-D-glucopyranosyloxy)-4-[(4-{2-[1-{[4-(2-hydroxyethyl)-piperazin-1-yl]carbonyl}-1-(methyl)ethylcarbamoyl]ethoxy}-2-methylphenyl)methyl]-5-isopropyl-1*H*-pyrazole;

3-(β-D-glucopyranosyloxy)-5-isopropyl-4-{[4-(2-{1-[(piperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}-ethoxy)-2-methylphenyl]methyl}-1*H*-pyrazole;

3-(β-D-glucopyranosyloxy)-5-isopropyl-4-{[4-(3-{1-[(piperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}-propyl)-2-methylphenyl]methyl}-1*H*-pyrazole;

3-(β-D-glucopyranosyloxy)-5-isopropyl-4-{[4-(3-{1-[(piperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}-

propoxy)-2-methylphenyl]methyl}-1*H*-pyrazole;

3-(β-D-galactopyranosyloxy)-5-isopropyl-4-{[4-(3-{1-[(piperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}-propoxy)-2-methylphenyl]methyl}-1*H*-pyrazole;

4-{[2-fluoro-4-(3-{1-[(piperazin-1-yl)carbonyl]-1-(methyl)-ethylcarbamoyl}propyl)phenyl]methyl}-3-(β-D-galacto-pyranosyloxy)-5-isopropyl-1*H*-pyrazole, and pharmaceutically acceptable salts thereof;

[15] a pharmaceutical composition comprising as an active ingredient a pyrazole derivative described in any one of the above [1]-[14], a pharmaceutically acceptable salt thereof or a prodrug thereof;

[16] a human SGLT1 inhibitor comprising as an active ingredient a pyrazole derivative described in any one of the above [1]-[14], a pharmaceutically acceptable salt thereof or a prodrug thereof;

[17] an agent for inhibiting postprandial hyperglycemia comprising as an active ingredient a pyrazole derivative described in any one of the above [1]-[14], a pharmaceutically acceptable salt thereof or a prodrug thereof;

[18] an agent for the prevention or treatment of a disease associated with hyperglycemia, which comprises as an active ingredient a pyrazole derivative described in any one of the above [1]-[14], a pharmaceutically acceptable salt thereof or a prodrug thereof;

[19] an agent for the prevention or treatment described in the above [18] wherein the disease associated with

hyperglycemia is a disease selected from the group consisting of diabetes, impaired glucose tolerance, diabetic complications, obesity, hyperinsulinemia, hyperlipidemia, hypercholesterolemia, hypertriglyceridemia, lipid metabolism disorder, atherosclerosis, hypertension, congestive heart failure, edema, hyperuricemia and gout;

[20] an agent for the inhibition of advancing impaired glucose tolerance or impaired fasting glycemia into diabetes in a subject, which comprises as an active ingredient a pyrazole derivative described in any one of the above [1]-[14], a pharmaceutically acceptable salt thereof or a prodrug thereof;

[21] an agent for the prevention or treatment of a disease associated with the increase of blood galactose level, which comprises as an active ingredient a pyrazole derivative described in any one of the above [1]-[14], a pharmaceutically acceptable salt thereof or a prodrug thereof;

[22] an agent for the prevention or treatment described in the above [21] wherein the disease associated with the increase of blood galactose level is galactosemia;

[23] a pharmaceutical composition described in the above [15] wherein the dosage form is sustained release formulation;

[24] an agent described in any one of the above [16]-[22] wherein the dosage form is sustained release formulation;

[25] a method for the prevention or treatment of a disease associated with hyperglycemia, which comprises administering an effective amount of a pyrazole derivative described in any one of the above [1]-[14], a pharmaceutically acceptable salt

thereof or a prodrug thereof;

[26] a method for the inhibition of advancing impaired glucose tolerance into diabetes in a subject, which comprises administering an effective amount of a pyrazole derivative described in any one of the above [1]-[14], a pharmaceutically acceptable salt thereof or a prodrug thereof;

[27] a use of a pyrazole derivative described in any one of the above [1]-[14], a pharmaceutically acceptable salt thereof or a prodrug thereof for the manufacture of a pharmaceutical composition for the prevention or treatment of a disease associated with hyperglycemia;

[28] a use of a pyrazole derivative described in any one of the above [1]-[14], a pharmaceutically acceptable salt thereof or a prodrug thereof for the manufacture of a pharmaceutical composition for the inhibition of advancing impaired glucose tolerance into diabetes in a subject;

[29] a pharmaceutical combination which comprises (A) a pyrazole derivative described in any one of the above [1]-[14], a pharmaceutically acceptable salt thereof or a prodrug thereof, and (B) at least one member selected from the group consisting of an insulin sensitivity enhancer, a glucose absorption inhibitor, a biguanide, an insulin secretion enhancer, a SGLT2 inhibitor, an insulin or insulin analogue, a glucagon receptor antagonist, an insulin receptor kinase stimulant, a tripeptidyl peptidase II inhibitor, a dipeptidyl peptidase IV inhibitor, a protein tyrosine phosphatase-1B inhibitor, a glycogen phosphorylase inhibitor, a glucose-6-phosphatase inhibitor, a

fructose-bisphosphatase inhibitor, a pyruvate dehydrogenase inhibitor, a hepatic gluconeogenesis inhibitor, D-chiroinsitol, a glycogen synthase kinase-3 inhibitor, glucagon-like peptide-1, a glucagon-like peptide-1 analogue, a glucagon-like peptide-1 agonist, amylin, an amylin analogue, an amylin agonist, an aldose reductase inhibitor, an advanced glycation endproducts formation inhibitor, a protein kinase C inhibitor, a γ-aminobutyric acid receptor antagonist, a sodium channel antagonist, a transcript factor NF-κB inhibitor, a lipid peroxidase inhibitor, an *N*-acetylated-α-linked-acid-dipeptidase inhibitor, insulin-like growth factor-I, platelet-derived growth factor, a platelet-derived growth factor analogue, epidermal growth factor, nerve growth factor, a carnitine derivative, uridine, 5-hydroxy-1-methylhidantoin, EGB-761, bimoclomol, sulodexide, Y-128, antidiarrhoics, cathartics, a hydroxymethylglutaryl coenzyme A reductase inhibitor, a fibric acid derivative, a β_3-adrenoceptor agonist, an acyl-coenzyme A cholesterol acyltransferase inhibitor, probcol, a thyroid hormone receptor agonist, a cholesterol absorption inhibitor, a lipase inhibitor, a microsomal triglyceride transfer protein inhibitor, a lipoxygenase inhibitor, a carnitine palmitoyl-transferase inhibitor, a squalene synthase inhibitor, a low-density lipoprotein receptor enhancer, a nicotinic acid derivative, a bile acid sequestrant, a sodium/bile acid cotransporter inhibitor, a cholesterol ester transfer protein inhibitor, an appetite suppressant, an angiotensin-converting enzyme inhibitor, a neutral

endopeptidase inhibitor, an angiotensin II receptor antagonist, an endothelin-converting enzyme inhibitor, an endothelin receptor antagonist, a diuretic agent, a calcium antagonist, a vasodilating antihypertensive agent, a sympathetic blocking agent, a centrally acting antihypertensive agent, an α_2-adrenoceptor agonist, an antiplatelets agent, a uric acid synthesis inhibitor, a uricosuric agent and a urinary alkalinizer;

[30] a method for the prevention or treatment of a disease associated with hyperglycemia, which comprises administering an effective amount of (A) a pyrazole derivative described in any one of the above [1]-[14], a pharmaceutically acceptable salt thereof or a prodrug thereof, and (B) at least one member selected from the group consisting of an insulin sensitivity enhancer, a glucose absorption inhibitor, a biguanide, an insulin secretion enhancer, a SGLT2 inhibitor, an insulin or insulin analogue, a glucagon receptor antagonist, an insulin receptor kinase stimulant, a tripeptidyl peptidase II inhibitor, a dipeptidyl peptidase IV inhibitor, a protein tyrosine phosphatase-1B inhibitor, a glycogen phosphorylase inhibitor, a glucose-6-phosphatase inhibitor, a fructose-bisphosphatase inhibitor, a pyruvate dehydrogenase inhibitor, a hepatic gluconeogenesis inhibitor, D-chiroinsitol, a glycogen synthase kinase-3 inhibitor, glucagon-like peptide-1, a glucagon-like peptide-1 analogue, a glucagon-like peptide-1 agonist, amylin, an amylin analogue, an amylin agonist, an aldose reductase inhibitor, an advanced glycation endproducts formation

inhibitor, a protein kinase C inhibitor, a γ-aminobutyric acid receptor antagonist, a sodium channel antagonist, a transcript factor NF-κB inhibitor, a lipid peroxidase inhibitor, an *N*-acetylated-α-linked-acid-dipeptidase inhibitor, insulin-like growth factor-I, platelet-derived growth factor, a platelet-derived growth factor analogue, epidermal growth factor, nerve growth factor, a carnitine derivative, uridine, 5-hydroxy-1-methylhidantoin, EGB-761, bimoclomol, sulodexide, Y-128, antidiarrhoics, cathartics, a hydroxymethylglutaryl coenzyme A reductase inhibitor, a fibric acid derivative, a β_3-adrenoceptor agonist, an acyl-coenzyme A cholesterol acyltransferase inhibitor, probcol, a thyroid hormone receptor agonist, a cholesterol absorption inhibitor, a lipase inhibitor, a microsomal triglyceride transfer protein inhibitor, a lipoxygenase inhibitor, a carnitine palmitoyl-transferase inhibitor, a squalene synthase inhibitor, a low-density lipoprotein receptor enhancer, a nicotinic acid derivative, a bile acid sequestrant, a sodium/bile acid cotransporter inhibitor, a cholesterol ester transfer protein inhibitor, an appetite suppressant, an angiotensin-converting enzyme inhibitor, a neutral endopeptidase inhibitor, an angiotensin II receptor antagonist, an endothelin-converting enzyme inhibitor, an endothelin receptor antagonist, a diuretic agent, a calcium antagonist, a vasodilating antihypertensive agent, a sympathetic blocking agent, a centrally acting antihypertensive agent, an α_2-adrenoceptor agonist, an antiplatelets agent, a uric acid synthesis inhibitor, a

uricosuric agent and a urinary alkalinizer;

[31] a method for the inhibition of advancing impaired glucose tolerance into diabetes in a subject, which comprises administering an effective amount of (A) a pyrazole derivative described in any one of the above [1]-[14], a pharmaceutically acceptable salt thereof or a prodrug thereof, and (B) at least one member selected from the group consisting of an insulin sensitivity enhancer, a glucose absorption inhibitor, a biguanide, an insulin secretion enhancer, a SGLT2 inhibitor, an insulin or insulin analogue, a glucagon receptor antagonist, an insulin receptor kinase stimulant, a tripeptidyl peptidase II inhibitor, a dipeptidyl peptidase IV inhibitor, a protein tyrosine phosphatase-1B inhibitor, a glycogen phosphorylase inhibitor, a glucose-6-phosphatase inhibitor, a fructose-bisphosphatase inhibitor, a pyruvate dehydrogenase inhibitor, a hepatic gluconeogenesis inhibitor, D-chiroinsitol, a glycogen synthase kinase-3 inhibitor, glucagon-like peptide-1, a glucagon-like peptide-1 analogue, a glucagon-like peptide-1 agonist, amylin, an amylin analogue, an amylin agonist, an aldose reductase inhibitor, an advanced glycation endproducts formation inhibitor, a protein kinase C inhibitor, a γ-aminobutyric acid receptor antagonist, a sodium channel antagonist, a transcript factor NF-κB inhibitor, a lipid peroxidase inhibitor, an *N*-acetylated-α-linked-acid-dipeptidase inhibitor, insulin-like growth factor-I, platelet-derived growth factor, a platelet-derived growth factor analogue, epidermal growth factor, nerve growth factor,

a carnitine derivative, uridine, 5-hydroxy-1-methylhidantoin, EGB-761, bimoclomol, sulodexide, Y-128, antidiarrhoics, cathartics, a hydroxymethylglutaryl coenzyme A reductase inhibitor, a fibric acid derivative, a β_3-adrenoceptor agonist, an acyl-coenzyme A cholesterol acyltransferase inhibitor, probcol, a thyroid hormone receptor agonist, a cholesterol absorption inhibitor, a lipase inhibitor, a microsomal triglyceride transfer protein inhibitor, a lipoxygenase inhibitor, a carnitine palmitoyl-transferase inhibitor, a squalene synthase inhibitor, a low-density lipoprotein receptor enhancer, a nicotinic acid derivative, a bile acid sequestrant, a sodium/bile acid cotransporter inhibitor, a cholesterol ester transfer protein inhibitor, an appetite suppressant, an angiotensin-converting enzyme inhibitor, a neutral endopeptidase inhibitor, an angiotensin II receptor antagonist, an endothelin-converting enzyme inhibitor, an endothelin receptor antagonist, a diuretic agent, a calcium antagonist, a vasodilating antihypertensive agent, a sympathetic blocking agent, a centrally acting antihypertensive agent, an α_2-adrenoceptor agonist, an antiplatelets agent, a uric acid synthesis inhibitor, a uricosuric agent and a urinary alkalinizer;

[32] a use of (A) a pyrazole derivative described in any one of the above [1]-[14], a pharmaceutically acceptable salt thereof or a prodrug thereof, and (B) at least one member selected from the group consisting of an insulin sensitivity enhancer, a glucose absorption inhibitor, a biguanide, an insulin secretion

enhancer, a SGLT2 inhibitor, an insulin or insulin analogue, a glucagon receptor antagonist, an insulin receptor kinase stimulant, a tripeptidyl peptidase II inhibitor, a dipeptidyl peptidase IV inhibitor, a protein tyrosine phosphatase-1B inhibitor, a glycogen phosphorylase inhibitor, a glucose-6-phosphatase inhibitor, a fructose-bisphosphatase inhibitor, a pyruvate dehydrogenase inhibitor, a hepatic gluconeogenesis inhibitor, D-chiroinsitol, a glycogen synthase kinase-3 inhibitor, glucagon-like peptide-1, a glucagon-like peptide-1 analogue, a glucagon-like peptide-1 agonist, amylin, an amylin analogue, an amylin agonist, an aldose reductase inhibitor, an advanced glycation endproducts formation inhibitor, a protein kinase C inhibitor, a γ-aminobutyric acid receptor antagonist, a sodium channel antagonist, a transcript factor NF-κB inhibitor, a lipid peroxidase inhibitor, an *N*-acetylated-α-linked-acid-dipeptidase inhibitor, insulin-like growth factor-I, platelet-derived growth factor, a platelet-derived growth factor analogue, epidermal growth factor, nerve growth factor, a carnitine derivative, uridine, 5-hydroxy-1-methylhidantoin, EGB-761, bimoclomol, sulodexide, Y-128, antidiarrhoics, cathartics, a hydroxymethylglutaryl coenzyme A reductase inhibitor, a fibric acid derivative, a β_3-adrenoceptor agonist, an acyl-coenzyme A cholesterol acyltransferase inhibitor, probcol, a thyroid hormone receptor agonist, a cholesterol absorption inhibitor, a lipase inhibitor, a microsomal triglyceride transfer protein inhibitor, a lipoxygenase inhibitor, a carnitine palmitoyl-transferase inhibitor, a

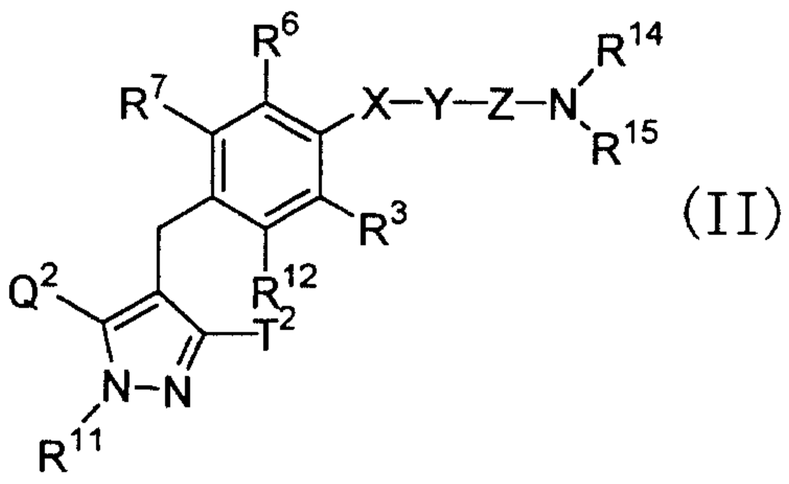
squalene synthase inhibitor, a low-density lipoprotein receptor enhancer, a nicotinic acid derivative, a bile acid sequestrant, a sodium/bile acid cotransporter inhibitor, a cholesterol ester transfer protein inhibitor, an appetite suppressant, an angiotensin-converting enzyme inhibitor, a neutral endopeptidase inhibitor, an angiotensin II receptor antagonist, an endothelin-converting enzyme inhibitor, an endothelin receptor antagonist, a diuretic agent, a calcium antagonist, a vasodilating antihypertensive agent, a sympathetic blocking agent, a centrally acting antihypertensive agent, an α_2-adrenoceptor agonist, an antiplatelets agent, a uric acid synthesis inhibitor, a uricosuric agent and a urinary alkalinizer, for the manufacture of a pharmaceutical composition for the prevention or treatment of a disease associated with hyperglycemia;

[33] a use of (A) a pyrazole derivative described in any one of the above [1]-[14], a pharmaceutically acceptable salt thereof or a prodrug thereof, and (B) at least one member selected from the group consisting of an insulin sensitivity enhancer, a glucose absorption inhibitor, a biguanide, an insulin secretion enhancer, a SGLT2 inhibitor, an insulin or insulin analogue, a glucagon receptor antagonist, an insulin receptor kinase stimulant, a tripeptidyl peptidase II inhibitor, a dipeptidyl peptidase IV inhibitor, a protein tyrosine phosphatase-1B inhibitor, a glycogen phosphorylase inhibitor, a glucose-6-phosphatase inhibitor, a fructose-bisphosphatase inhibitor, a pyruvate dehydrogenase inhibitor, a hepatic gluconeogenesis

inhibitor, D-chiroinsitol, a glycogen synthase kinase-3 inhibitor, glucagon-like peptide-1, a glucagon-like peptide-1 analogue, a glucagon-like peptide-1 agonist, amylin, an amylin analogue, an amylin agonist, an aldose reductase inhibitor, an advanced glycation endproducts formation inhibitor, a protein kinase C inhibitor, a γ-aminobutyric acid receptor antagonist, a sodium channel antagonist, a transcript factor NF-κB inhibitor, a lipid peroxidase inhibitor, an *N*-acetylated-α-linked-acid-dipeptidase inhibitor, insulin-like growth factor-I, platelet-derived growth factor, a platelet-derived growth factor analogue, epidermal growth factor, nerve growth factor, a carnitine derivative, uridine, 5-hydroxy-1-methylhidantoin, EGB-761, bimoclomol, sulodexide, Y-128, antidiarrhoics, cathartics, a hydroxymethylglutaryl coenzyme A reductase inhibitor, a fibric acid derivative, a β_3-adrenoceptor agonist, an acyl-coenzyme A cholesterol acyltransferase inhibitor, probcol, a thyroid hormone receptor agonist, a cholesterol absorption inhibitor, a lipase inhibitor, a microsomal triglyceride transfer protein inhibitor, a lipoxygenase inhibitor, a carnitine palmitoyl-transferase inhibitor, a squalene synthase inhibitor, a low-density lipoprotein receptor enhancer, a nicotinic acid derivative, a bile acid sequestrant, a sodium/bile acid cotransporter inhibitor, a cholesterol ester transfer protein inhibitor, an appetite suppressant, an angiotensin-converting enzyme inhibitor, a neutral endopeptidase inhibitor, an angiotensin II receptor antagonist, an endothelin-converting enzyme inhibitor, an endothelin

receptor antagonist, a diuretic agent, a calcium antagonist, a vasodilating antihypertensive agent, a sympathetic blocking agent, a centrally acting antihypertensive agent, an α_2-adrenoceptor agonist, an antiplatelets agent, a uric acid synthesis inhibitor, a uricosuric agent and a urinary alkalinizer, for the manufacture of a pharmaceutical composition for the inhibition of advancing impaired glucose tolerance into diabetes in a subject;

[34] a pyrazole derivative represented by the general formula:



(II)

wherein

R^{11} represents a hydrogen atom, a C_{1-6} alkyl group, a C_{2-6} alkenyl group, a hydroxy(C_{2-6} alkyl) group which may have a protective group, a C_{3-7} cycloalkyl group, a C_{3-7} cycloalkyl-substituted (C_{1-6} alkyl) group, an aryl group which may have the same or different 1 to 3 substituents selected from the group consisting of a halogen atom, a hydroxy group which may have a protective group, an amino group which may have a protective group, a C_{1-6} alkyl group and a C_{1-6} alkoxy group, or an aryl(C_{1-6} alkyl) group which may have the same or different 1 to 3 substituents selected from the group consisting of a halogen

atom, a hydroxy group which may have a protective group, an amino group which may have a protective group, a C_{1-6} alkyl group and a C_{1-6} alkoxy group on the ring;

one of Q^2 and T^2 represents a 2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy group or a 2,3,4,6-tetra-*O*-acetyl-β-D-galactopyranosyloxy group, while the other represents a C_{1-6} alkyl group, a halo(C_{1-6} alkyl) group, a C_{1-6} alkoxy-substituted (C_{1-6} alkyl) group or a C_{3-7} cycloalkyl group;

R^{12} represents a hydrogen atom, a halogen atom, a hydroxy group which may have a protective group, a C_{1-6} alkyl group, a C_{1-6} alkoxy group, a C_{1-6} alkylthio group, a halo(C_{1-6} alkyl) group, a halo(C_{1-6} alkoxy) group, a C_{1-6} alkoxy-substituted (C_{1-6} alkoxy) group, a C_{3-7} cycloalkyl- substituted (C_{2-6} alkoxy) group or a group of the general formula: -A-R^{18} in which A represents a single bond, an oxygen atom, a methylene group, an ethylene group, $-OCH_2-$ or $-CH_2O-$; and R^{18} represents a C_{3-7} cycloalkyl group, a C_{2-6} heterocycloalkyl group, an aryl group which may have the same or different 1 to 3 substituents selected from the group consisting of a halogen atom, a hydroxy group which may have a protective group, an amino group which may have a protective group, a C_{1-6} alkyl group, a C_{1-6} alkoxy group, a C_{2-6} alkenyloxy group, a halo(C_{1-6} alkyl) group, a hydroxy(C_{1-6} alkyl) group which may have a protective group, a carboxy group which may have a protective group, a C_{2-7} alkoxycarbonyl group, a cyano group and a nitro group, or a heteroaryl group which may have a substituent selected from the group consisting of a halogen atom and a C_{1-6} alkyl group;

X represents a single bond, an oxygen atom or a sulfur atom;

Y represents a single bond, a C_{1-6} alkylene group or a C_{2-6} alkenylene group with the proviso that X is a single bond when Y is a single bond;

Z represents a carbonyl group or a sulfonyl group;

R^{14} and R^{15} are the same or different, and each represents a hydrogen atom or a C_{1-6} alkyl group which may have the same or different 1 to 3 groups selected from the following substituent group (ii), or they bind together with the neighboring nitrogen atom to form a C_{2-6} cyclic amino group which may have a substituent selected from the group consisting of a C_{1-6} alkyl group and a hydroxy(C_{1-6} alkyl) group which may have a protective group;

R^{3}, R^{6} and R^{7} are the same or different, and each represents a hydrogen atom, a halogen atom, a C_{1-6} alkyl group or a C_{1-6} alkoxy group; and

substituent group (ii) consists of a hydroxy group which may have a protective group, an amino group which may have a protective group, a mono or di(C_{1-6} alkyl)amino group which may have a protective group, a mono or di[hydroxy(C_{1-6} alkyl)]amino group which may have a protective group, an ureido group, a sulfamide group, a mono or di(C_{1-6} alkyl)ureido group, a mono or di(C_{1-6} alkyl)sulfamide group, a C_{2-7} acylamino group, a C_{1-6} alkylsulfonylamino group, a group of the general formula: $-CON(R^{19})R^{20}$ in which R^{19} and R^{20} are the same or different, and each represents a hydrogen atom or a C_{1-6} alkyl group which may have the same or different 1 to 3 substituents selected from

the group consisting of a hydroxy group which may have a protective group, an amino group which may have a protective group, a mono or di(C_{1-6} alkyl)amino group which may have a protective group, a mono or di[hydroxy(C_{1-6} alkyl)]amino group which may have a protective group, an ureido group, a mono or di(C_{1-6} alkyl)ureido group, a C_{2-7} acylamino group, a C_{1-6} alkylsulfonylamino group and a carbamoyl group, or they bind together with the neighboring nitrogen atom to form a C_{2-6} cyclic amino group which may have a substituent selected from the group consisting of a C_{1-6} alkyl group and a hydroxy(C_{1-6} alkyl) group which may have a protective group, a C_{3-7} cycloalkyl group, a C_{2-6} heterocycloalkyl group, an aryl group which may have the same or different 1 to 3 substituents selected from the group consisting of a halogen atom, a hydroxy group which may have a protective group, an amino group which may have a protective group, a C_{1-6} alkyl group and a C_{1-6} alkoxy group, a heteroaryl group which may have a substituent selected from the group consisting of a halogen atom and a C_{1-6} alkyl group, a C_{2-6} cyclic amino group which may have a substituent selected from the group consisting of a C_{1-6} alkyl group and a hydroxy(C_{1-6} alkyl) group which may have a protective group, and a C_{1-4} aromatic cyclic amino group which may have a C_{1-6} alkyl group as a substituent, or a salt thereof; and the like.

In the present invention, the term "C_{1-6} alkyl group" means a straight-chained or branched alkyl group having 1 to 6 carbon atoms such as a methyl group, an ethyl group, a propyl group, an isopropyl group, a butyl group, an isobutyl group, a *sec*-butyl

group, a *tert*-butyl group, a pentyl group, an isopentyl group, a neopentyl group, a *tert*-pentyl group, a hexyl group or the like; the term "C_{1-6} alkylene group" means a straight-chained or branched alkylene group having 1 to 6 carbon atoms such as a methylene group, an ethylene group, a trimethylene group, a tetramethylene group, a propylene group, a 1,1-dimethylethylene group or the like; the term "hydroxy(C_{1-6} alkyl) group" means the above C_{1-6} alkyl group substituted by a hydroxy group; the term "C_{2-6} alkyl group" means a straight-chained or branched alkyl group having 2 to 6 carbon atoms such as an ethyl group, a propyl group, an isopropyl group, a butyl group, an isobutyl group, a *sec*-butyl group, a *tert*-butyl group, a pentyl group, an isopentyl group, a neopentyl group, a *tert*-pentyl group, a hexyl group or the like; the term "hydroxy(C_{2-6} alkyl) group" means the above C_{2-6} alkyl group substituted by a hydroxy group, such as a 2-hydroxyethyl group, a 3-hydroxypropyl group or the like; the term "C_{1-6} alkoxy group" means a straight-chained or branched alkoxy group having 1 to 6 carbon atoms such as a methoxy group, an ethoxy group, a propoxy group, an isopropoxy group, a butoxy group, an isobutoxy group, a *sec*-butoxy group, a *tert*-butoxy group, a pentyloxy group, an isopentyloxy group, a neopentyloxy group, a *tert*-pentyloxy group, a hexyloxy group or the like; the term "C_{1-6} alkoxy-substituted (C_{1-6} alkyl) group" means the above C_{1-6} alkyl group substituted by the above C_{1-6} alkoxy group; the term "C_{1-6} alkoxy-substituted (C_{1-6} alkoxy) group" means the above C_{1-6} alkoxy group substituted by the above C_{1-6} alkoxy group, such as a methoxymethoxy group or the like;

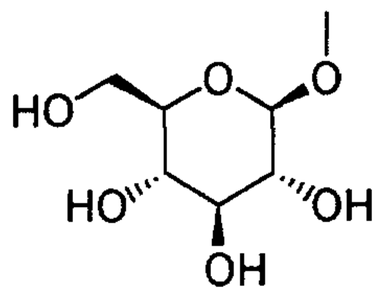
the term "C_{2-6} alkenyl group" means a straight-chained or branched alkenyl group having 2 to 6 carbon atoms such as a vinyl group, an allyl group, a 1-propenyl group, an isopropenyl group, a 1-butenyl group, a 2-butenyl group, a 2-methylallyl group or the like; the term "C_{2-6} alkenylene group" means a straight-chained or branched alkenylene group having 2 to 6 carbon atoms such as a vinylene group, a propenylene group or the like; the term "C_{2-6} alkenyloxy group" means the above C_{1-6} alkoxy group except for a methoxy group which has an unsaturated bond, such as an allyloxy group or the like; the term "C_{1-6} alkylthio group" means a straight-chained or branched alkylthio group having 1 to 6 carbon atoms such as a methylthio group, an ethylthio group, a propylthio group, an isopropylthio group, a butylthio group, an isobutylthio group, a *sec*-butylthio group, a *tert*-butylthio group, a pentylthio group, an isopentylthio group, a neopentylthio group, a *tert*-pentylthio group, a hexylthio group or the like; the term "mono or di(C_{1-6} alkyl)amino group" means an amino group mono-substituted by the above C_{1-6} alkyl group or di-substituted by the same or different C_{1-6} alkyl groups as defined above; the term "mono or di[hydroxy(C_{1-6} alkyl)]amino group" means an amino group mono-substituted by the above hydroxy(C_{1-6} alkyl) group or di-substituted by the same or different hydroxy(C_{1-6} alkyl) groups as defined above; the term "mono or di(C_{1-6} alkyl)ureido group" means an ureido group mono-substituted by the above C_{1-6} alkyl group or di-substituted by the same or different C_{1-6} alkyl groups as defined above; the term "mono or di(C_{1-6} alkyl)sulfamide group"

means a sulfamide group mono-substituted by the above C_{1-6} alkyl group or di-substituted by the same or different C_{1-6} alkyl groups as defined above; the term "C_{2-7} acylamino group" means an amino group substituted by a straight-chained or branched acyl group having 2 to 7 carbon atoms such as an acetyl group, a propionyl group, a butyryl group, an isobutyryl group, a valeryl group, a pivaloyl group, a hexanoyl group or the like; the term "C_{1-6} alkylsulfonylamino group" means an amino group substituted by a straight-chained or branched alkylsulfonyl group having 1 to 6 carbon atoms, such as a methanesulfonyl group, an ethanesulfonyl group or the like; the term "C_{3-7} cycloalkyl group" means a cyclopropyl group, a cyclobutyl group, a cyclopentyl group, a cyclohexyl group or a cycloheptyl group; the term "C_{3-7} cycloalkyl-substituted (C_{1-6} alkyl) group" means the above C_{1-6} alkyl group substituted by the above C_{3-7} cycloalkyl group; the term "C_{3-7} cycloalkyl-substituted (C_{2-6} alkoxy) group" means the above C_{1-6} alkoxy group except for a methoxy group substituted by the above C_{3-7} cycloalkyl group; the term "C_{2-6} heterocycloalkyl group" means the above C_{3-7} cycloalkyl group containing the same or different 1 or 2 hetero atoms other than the binding position selected from a nitrogen atom, an oxygen atom and a sulfur atom in the ring, which is derived from morpholine, thiomorpholine, tetrahydrofuran, tetrahydropyran, aziridine, azetidine, pyrrolidine, imidazolidine, oxazoline, piperidine, piperazine, pyrazolidine or the like; the term "halogen atom" means a fluorine atom, a chlorine atom, a bromine atom or an iodine atom; the term "halo(C_{1-6} alkyl) group" means the above

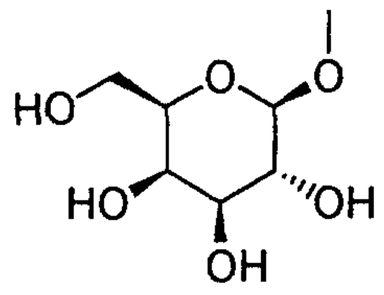
C_{1-6} alkyl group substituted by the same or different 1 to 5 halogen atoms as defined above, such as a trifluoromethyl group, a pentafluoroethyl group or the like; the term "halo(C_{1-6} alkoxy) group" means the above C_{1-6} alkoxy group substituted by the same or different 1 to 5 halogen atoms as defined above; the term "C_{2-7} alkoxycarbonyl group" means a straight-chained or branched alkoxycarbonyl group having 2 to 7 carbon atoms such as a methoxycarbonyl group, an ethoxycarbonyl group, a propoxy-carbonyl group, an isopropoxycarbonyl group, a butoxycarbonyl group, an isobutyloxycarbonyl group, a *sec*-butoxycarbonyl group, a *tert*-butoxycarbonyl group, a pentyloxycarbonyl group, an isopentyloxycarbonyl group, a neopentyloxycarbonyl group, a *tert*-pentyloxycarbonyl group, a hexyloxycarbonyl group or the like; the term "aryl group" means mono to tricyclic aromatic hydrocarbon group such as a phenyl group, a naphthyl group, or the like; the term "aryl(C_{1-6} alkyl) group" means the above C_{1-6} alkyl group substitute by the above aryl group; the term "heteroaryl group" means a 5 or 6-membered heteroaryl group containing the same or differenr 1 to 4 hetero atoms other than the binding position selected from a nitrogen atom, an oxygen atom and a sulfur atom in the ring, which is derived from thiazole, oxazole, isothiazole, isooxazole, pyridine, pyrimidine, pyrazine, pyridazine, pyrrole, thiophene, imidazole, pyrazole, oxadiazole, thiodiazole, tetrazole, furazan or the like; the term "C_{2-6} cyclic amino group" means a 5 or 6-membered monocyclic amino group having 2 to 6 carbon atoms which may contain one hetero atom other than the nitrogen atom at the binding position

selected from a nitrogen atom, an oxygen atom and a sulfur atom in the ring, such as a morpholino group, a thiomorpholino group, a 1-aziridinyl group, a 1-azetidinyl group, a 1-pyrrolidinyl group, a piperidino group, a 1-imidazolidinyl group, a 1-piperazinyl group, a pyrazolidinyl group or the like; the term "C_{1-4} aromatic cyclic amino group" means a 5-membered aromatic monocyclic amino group having 1 to 4 carbon atoms which may contain 1 to 3 nitrogen atoms other than the nitrogen atom at the binding position, such as a 1-imidazolyl group, a 1-pyrrolyl group, a pyrazolyl group, a 1-tetrazolyl group or the like; the term "hydroxy-protective group" means a hydroxy-protective group used in general organic synthesis such as a benzyl group, a methoxymethyl group, an acetyl group, a pivaloyl group, a benzoyl group, a *tert*-butyldimethylsilyl group, a triisopropylsilyl group, an allyl group or the like; the term "amino-protective group" means an amino-protective group used in general organic synthesis such as a benzyloxycarbonyl group, a *tert*-butoxy-carbonyl group, a benzyl group, a trifluoroacetyl group or the like; and the term "carboxy-protective group" means a carboxy-protective group used in general organic synthesis such as a benzyl group, a *tert*-butyldimethylsilyl group, an allyl group or the like.

In the present invention, for example, R^1 is preferably a hydrogen atom or a hydroxy(C_{2-6} alkyl) group, and is more preferably a hydrogen atom; T is preferably a group of the formula:



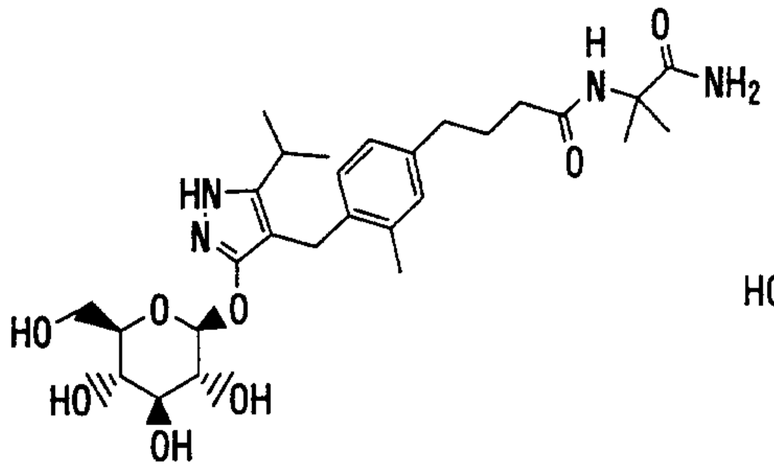
or a group of the formula:



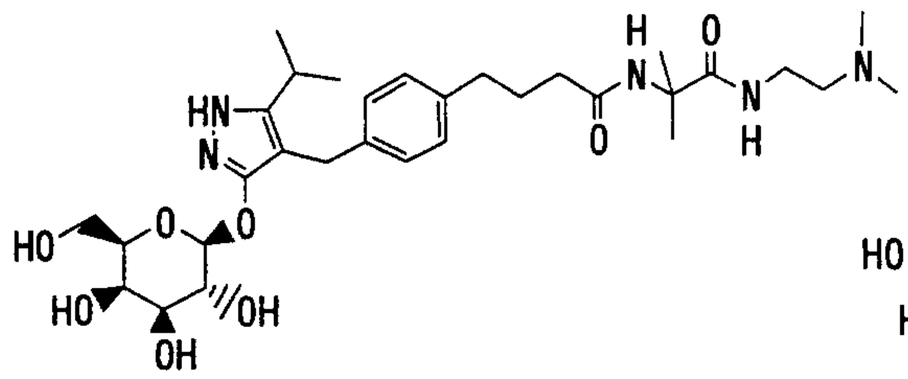
Q is preferably a C_{1-6} alkyl group or a halo(C_{1-6} alkyl) group, and is more preferably a C_{1-6} alkyl group; the C_{1-6} alkyl group in Q is preferably an ethyl group or an isopropyl group, and is more preferably an isopropyl group; X is preferably a single bond or an oxygen atom. Furthermore, when X is a single bond, Y is preferably a C_{1-6} alkylene group or a C_{2-6} alkenylene group, and is more preferably a trimethylene group or a 1-propenylene group; and when X is an oxygen atom, Y is preferably a C_{1-6} alkylene group, and is more preferably an ethylene group or a trimethylene group. Z is preferably a carbonyl group; R^2 is preferably a hydrogen atom, a halogen atom, a C_{1-6} alkyl group, a C_{1-6} alkoxy group, a C_{1-6} alkoxy-substituted (C_{2-6} alkoxy) group, a C_{3-7} cycloalkyl- substituted (C_{2-6} alkoxy) group or a group of the general formula: -A-R^8 in which A and R^8 have the same meanings as defined above, and is more preferably a hydrogen atom, a chlorine atom, a fluorine atom or a methyl group; one of R^4 and R^5 is preferably a C_{1-6} alkyl group which has 1 to 3 hydroxy groups or a group of the general formula: -CON(R^9)R^{10} in which R^9 and R^{10} are the same or different, and each represents a hydrogen

atom or a C_{1-6} alkyl group which may have the same or different 1 to 3 substituents selected from the group consisting of a hydroxy group, an amino group, a mono or di(C_{1-6} alkyl)amino group, a mono or di[hydroxy(C_{1-6} alkyl)]amino group, an ureido group, a mono or di(C_{1-6} alkyl)ureido group, a C_{2-7} acylamino group, a C_{1-6} alkylsulfonylamino group and a carbamoyl group, or they bind together with the neighboring nitrogen atom to form a C_{2-6} cyclic amino group which may have a substituent selected from the group consisting of a C_{1-6} alkyl group and a hydroxy(C_{1-6} alkyl) group, while the other is preferably a hydrogen atom, and one of R^4 and R^5 is more preferably a C_{1-6} alkyl group which has a group of the general formula: $-CON(R^{9A})R^{10A}$ in which R^{9A} and R^{10A} bind together with the neighboring nitrogen atom to form a C_{2-6} cyclic amino group which may have a substituent selected from the group consisting of a C_{1-6} alkyl group and a hydroxy(C_{1-6} alkyl) group, while the other is more preferably a hydrogen atom; and R^3, R^6 and R^7 are preferably a hydrogen atom or a halogen atom, and all of them are more preferably a hydrogen atom.

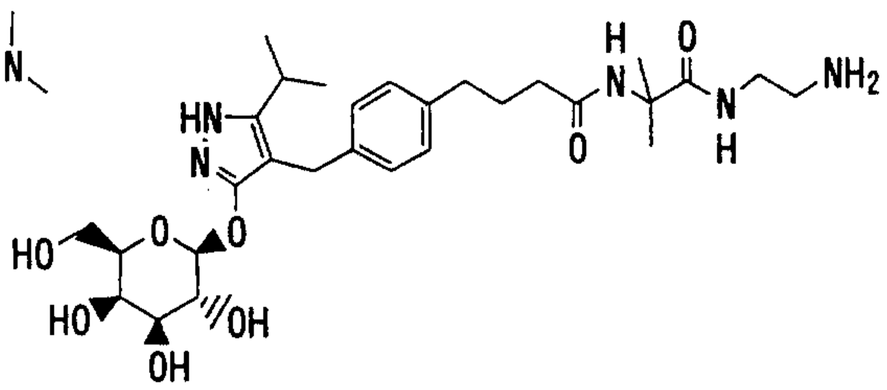
As concrete compounds in the present invention, compounds described in Examples 1-116 are examplified. Specifically, the following compounds or pharmaceutically acceptable salts thereof are preferable,



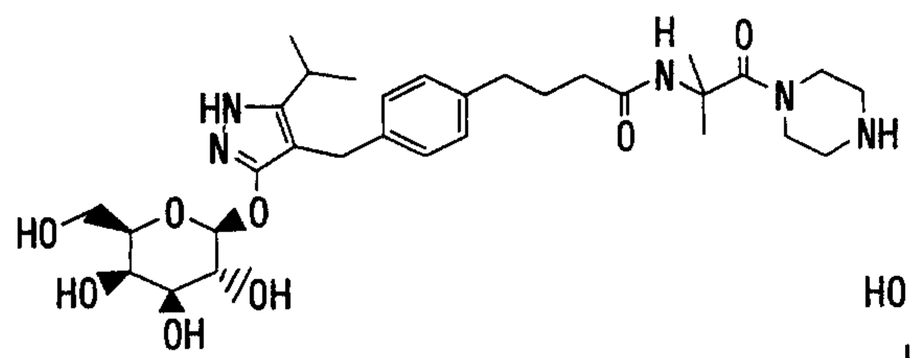
[Example 44]



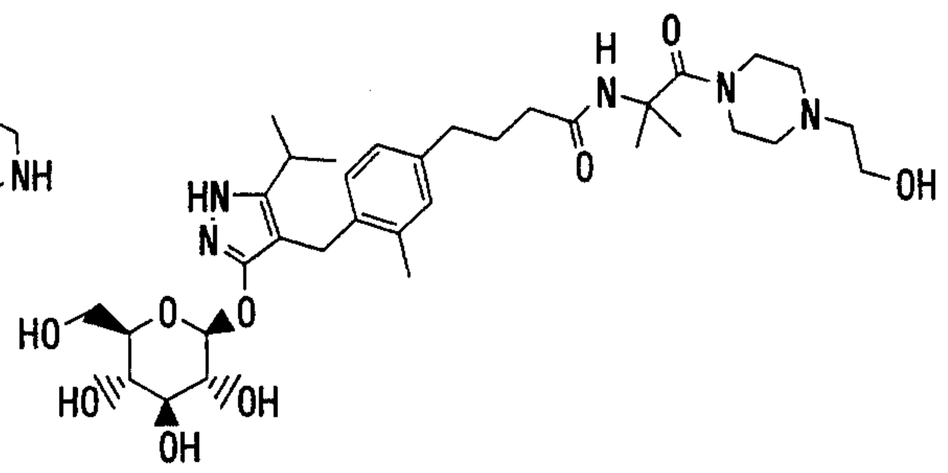
[Example 48]



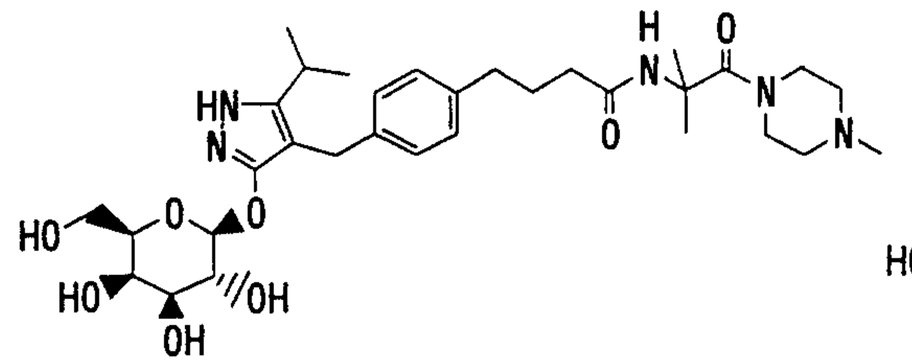
[Example 52]



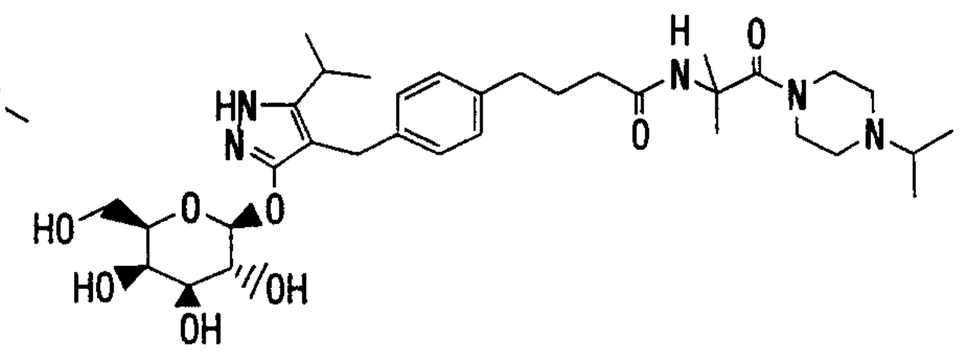
[Example 56]



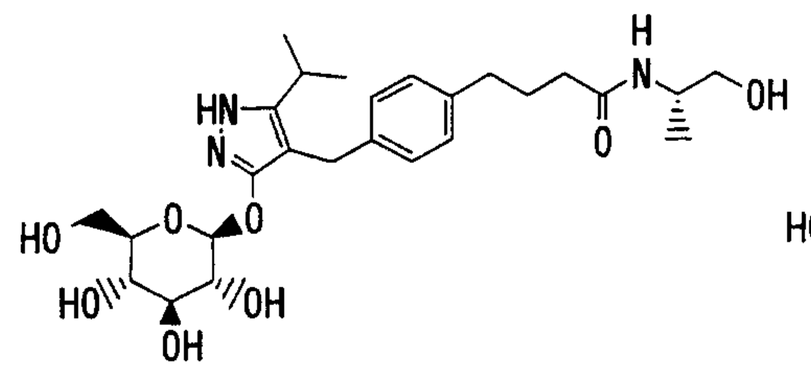
[Example 57]



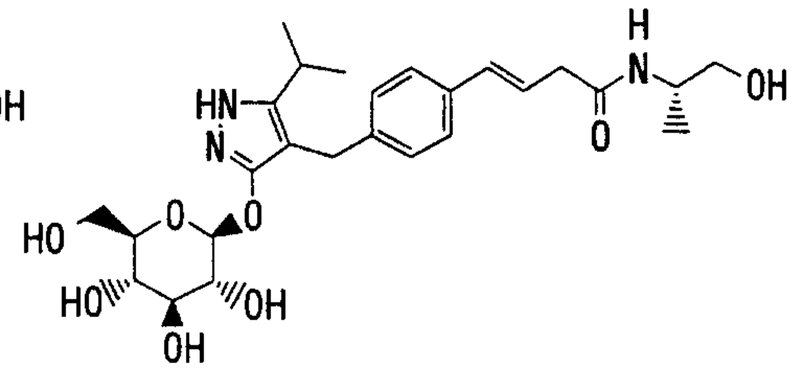
[Example 59]



[Example 61]

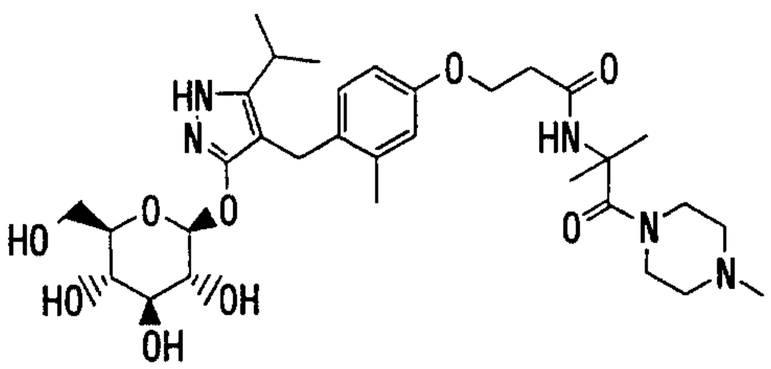


[Example 62]

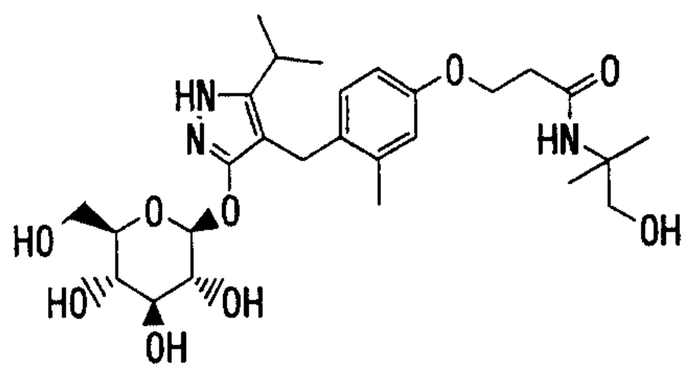


[Example 66]

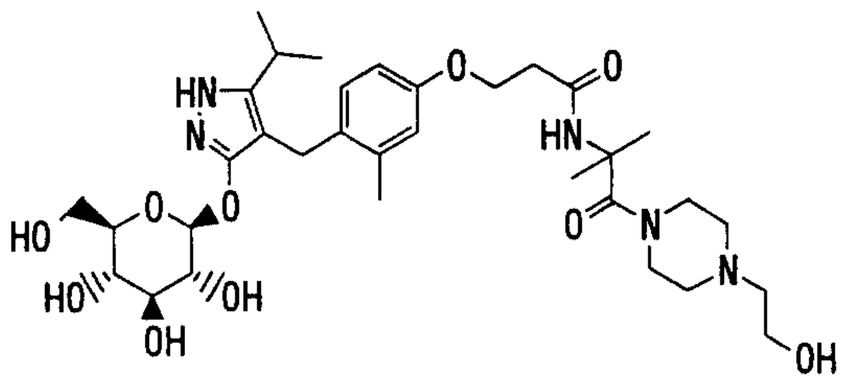
[Example 73]



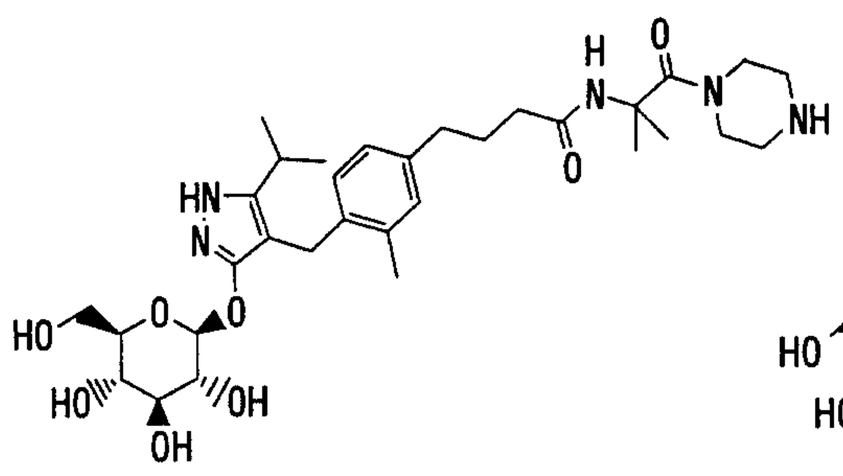
[Example 85]



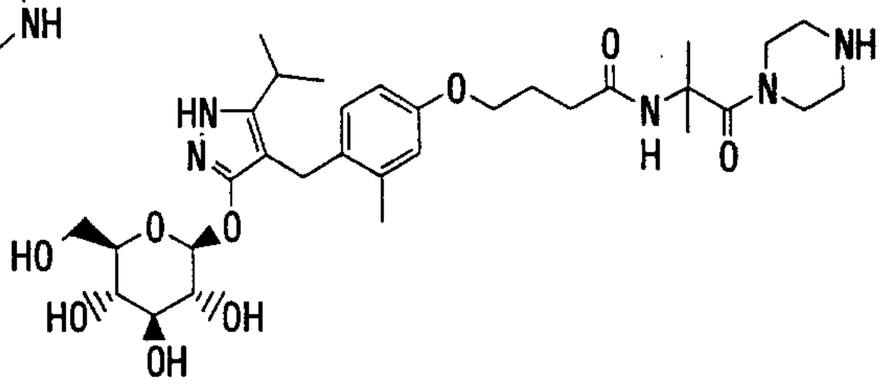
[Example 87]



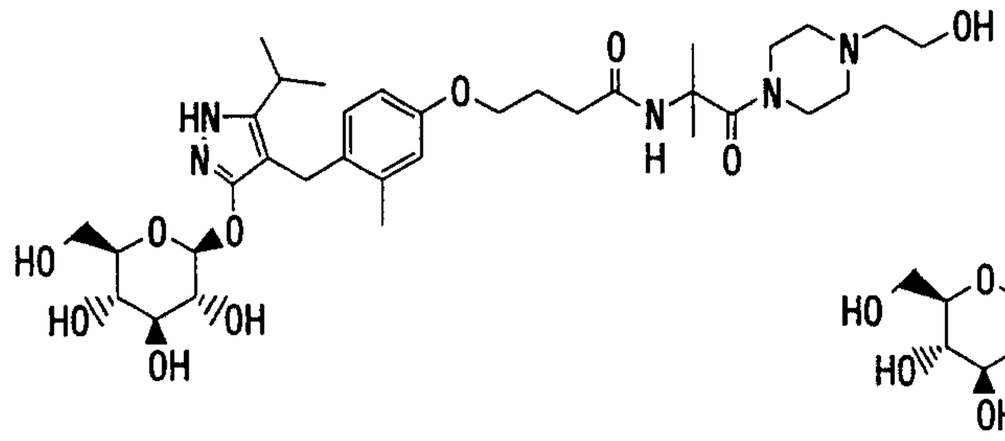
[Example 89]



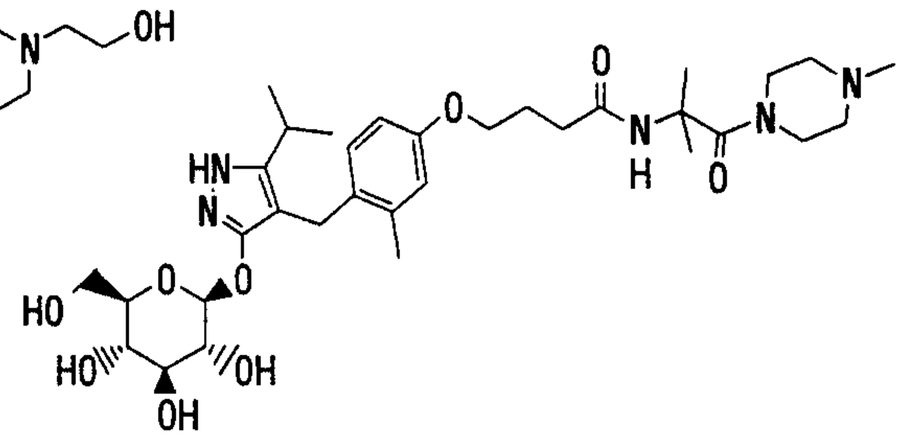
[Example 99]



[Example 103]

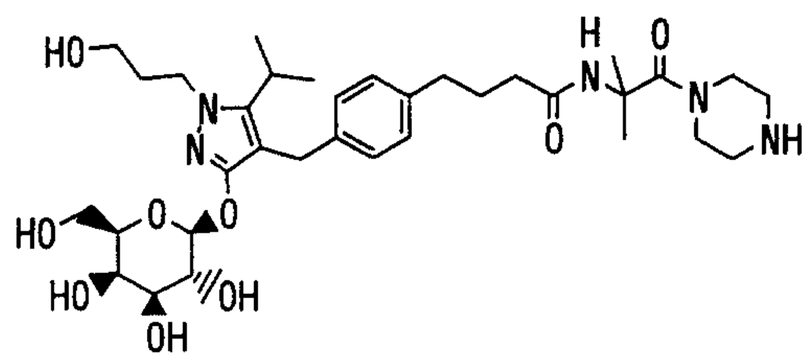


[Example 105]

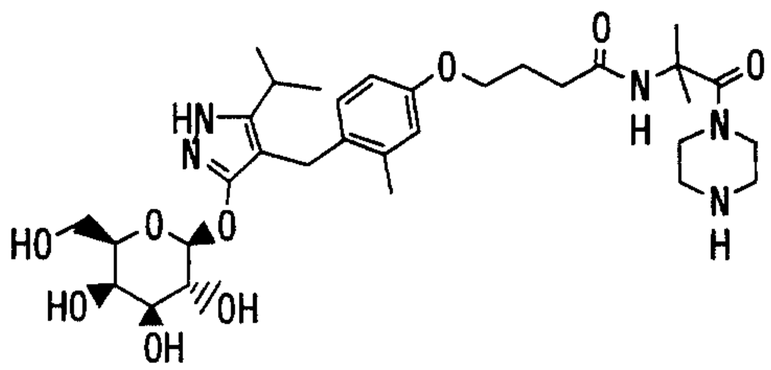


[Example 106]

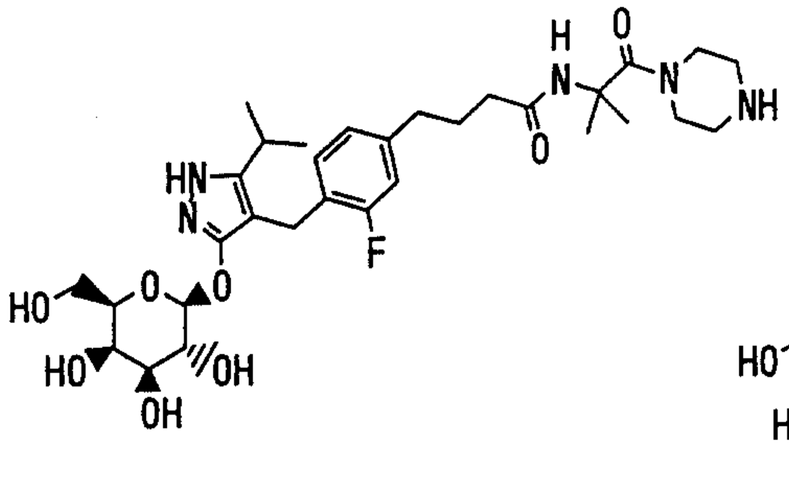
[Example 107]

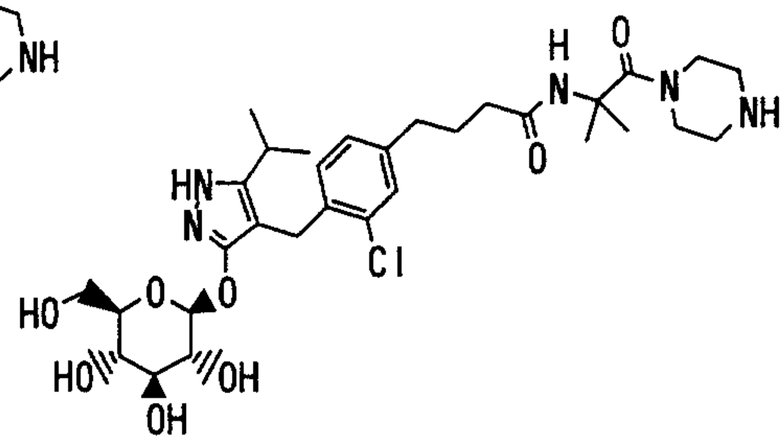


[Example 109]



[Example 112]





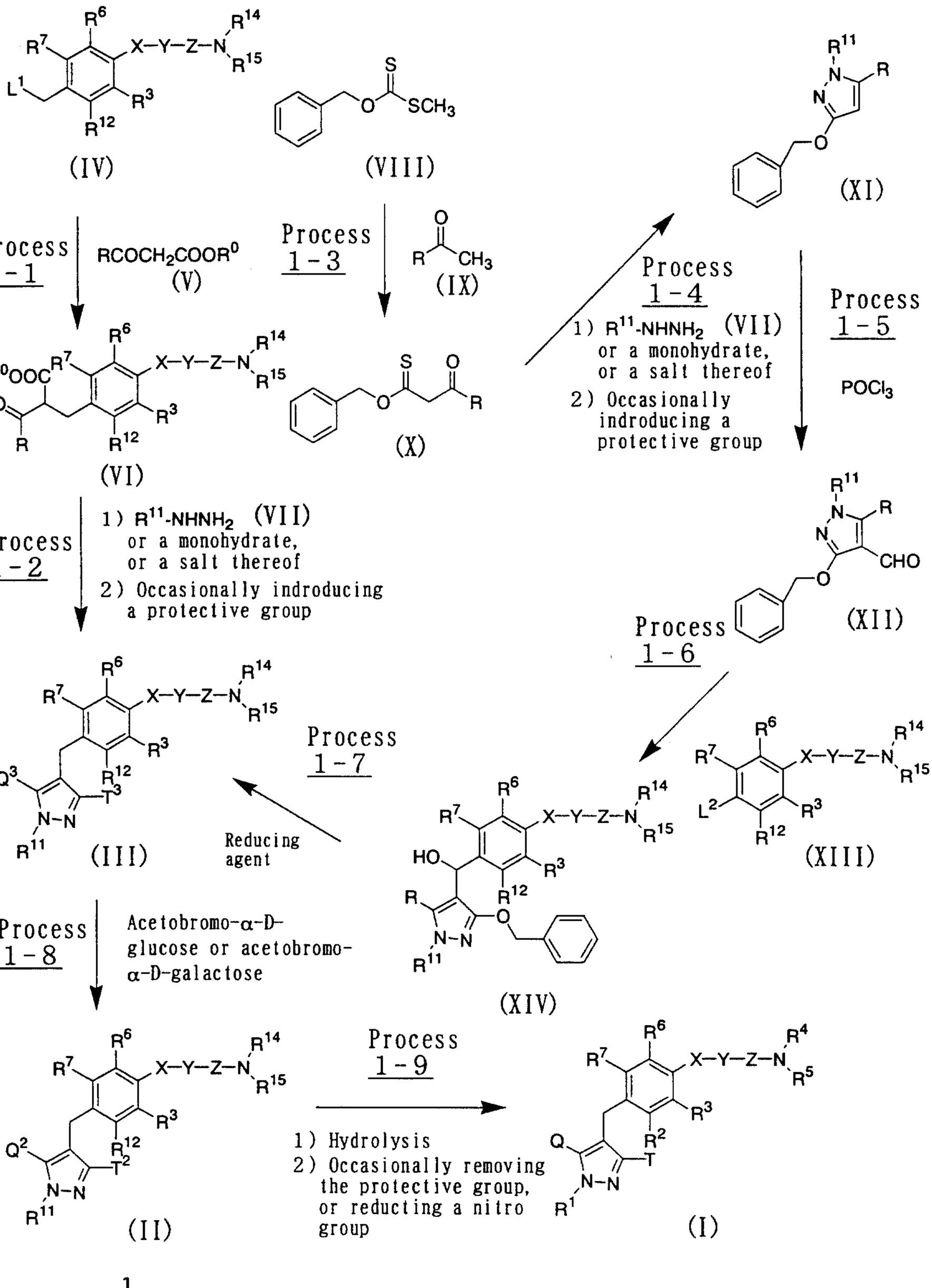
[Example 115]

[Example 116]

and 3-(β-D-galactopyranosyloxy)-4-[(4-{3-[1-{[4-(2-hydroxyethyl)piperazin-1-yl]carbonyl}-1-(methyl)ethylcarbamoyl]propyl}phenyl)methyl]-5-isopropyl-1*H*-pyrazole; 3-(β-D-galactopyranosyloxy)-5-isopropyl-4-{[4-(3-{1-[(piperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}propyl)phenyl]methyl}-1*H*-pyrazole; 3-(β-D-glucopyranosyloxy)-4-[(4-{3-[1-{[4-(2-hydroxyethyl)piperazin-1-yl]carbonyl}-1-(methyl)ethylcarbamoyl]propyl}-2-methylphenyl)methyl]-5-isopropyl-1*H*-pyrazole; 3-(β-D-galactopyranosyloxy)-5-isopropyl-4-{[4-(3-{1-[(4-methylpiperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}propyl)phenyl]methyl}-1*H*-pyrazole; 3-(β-D-glucopyranosyloxy)-5-isopropyl-4-{[4-(2-{1-[(4-methylpiperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}ethoxy)-2-methylphenyl]methyl}-1*H*-pyrazole; 3-(β-D-glucopyranosyloxy)-4-[(4-{2-[1-{[4-(2-hydroxyethyl)piperazin-1-yl]carbonyl}-1-(methyl)ethylcarbamoyl]ethoxy}-2-methylphenyl)methyl]-5-isopropyl-1*H*-pyrazole; 3-(β-D-glucopyranosyloxy)-5-isopropyl-4-{[4-(2-{1-[(piperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}ethoxy)-2-methylphenyl]methyl}-1*H*-pyrazole; 3-(β-D-glucopyranosyloxy)-5-isopropyl-4-{[4-(3-{1-[(piperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}-

propyl)-2-methylphenyl]methyl}-1*H*-pyrazole; 3-(β-D-gluco-pyranosyloxy)-5-isopropyl-4-{[4-(3-{1-[(piperazin-1-yl)-carbonyl]-1-(methyl)ethylcarbamoyl}propoxy)-2-methyl-phenyl]methyl}-1*H*-pyrazole; 3-(β-D-galactopyranosyloxy)-5-isopropyl-4-{[4-(3-{1-[(piperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}propoxy)-2-methylphenyl]methyl}-1*H*-pyrazole; 4-{[2-fluoro-4-(3-{1-[(piperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}propyl)phenyl]methyl}-3-(β-D-galactopyranosyloxy)-5-isopropyl-1*H*-pyrazole, or pharmaceutically acceptable salts thereof are more preferable.

For example, the compounds represented by the above general formula (I) of the present invention can be prepared according to the following procedure:



wherein L^1 represents a leaving group such as a halogen atom, a mesyloxy group, a tosyloxy group or the like; L^2 represents MgBr, MgCl, MgI, ZnI, ZnBr, ZnCl or a lithium atom; R represents a C_{1-6} alkyl group, a halo(C_{1-6} alkyl) group, a C_{1-6} alkoxy-

substituted (C_{1-6} alkyl) group or a C_{3-7} cycloalkyl group; R^0 represents a C_{1-6} alkyl group; one of Q^3 and T^3 represents a hydroxy group, the other represents a C_{1-6} alkyl group, a halo(C_{1-6} alkyl) group, a C_{1-6} alkoxy-substituted (C_{1-6} alkyl) group or a C_{3-7} cycloalkyl group; and R^1, R^2, R^3, R^4, R^5, R^6, R^7, R^{11}, R^{12}, R^{14}, R^{15}, Q, Q^2, T, T^2, X, Y and Z have the same meanings as defined above.

Process 1-1

A compound represented by the above general formula (VI) can be prepared by condensing a benzyl derivative represented by the above general formula (IV) with a ketoacetate represented by the above general formula (V) in the presence of a base such as sodium hydride or potassium *tert*-butoxide in an inert solvent.

As the inert solvent used in the reaction, for example, 1,2-dimethoxyethane, tetrahydrofuran, *N*,*N*-dimethylformamide, a mixed solvent thereof and the like can be illustrated. The reaction temperature is usually from room temperature to reflux temperature, and the reaction time is usually from 1 hour to 1 day, varying based on a used starting material, solvent and reaction temperature.

Process 1-2

A benzylpyrazole derivative represented by the above general formula (III) can be prepared by condensing a compound represented by the above general formula (VI) with a hydrazine compound represented by the above general formula (VII) or a monohydrate thereof, or a salt thereof in the presence or absence of a base in an inert solvent, and introducing a hydrogen-

protective in usual way as occasion demands. As the inert solvent used in the condensing reaction, for example, toluene, tetrahydrofuran, chloroform, methanol, ethanol, a mixed solvent thereof and the like can be illustrated, and as tha base, for example, triethylamine, *N*,*N*-diisopropylethylamine, pyridine, sodium methoxide, sodium ethoxide and the like can be illustrated. The reaction temperature is usually from room temperature to reflux temperature, and the reaction time is usually from 1 hour to 1 day, varying based on a used starting material, solvent and reaction temperature. The obtained benzylpyrazole derivative represented by the above general formula (III) can be also used in the subsequent process after suitably converting into a salt thereof in usual way.

Process 1-3

A compound represented by the above general formula (X) can be prepared by condensing dithiocarbonate ester compound represented by the above general formula (VIII) with a ketone compound represented by the above general formula (IX) in the presence of a base such as sodium amide in an inert solvent. As the inert solvent used in the reaction, for example, toluene and the like can be illustrated. The reaction temperature is usually from -20°C to room temperature, and the reaction time is usually from 30 minutes to 1 day, varying based on a used starting material, solvent and reaction temperature.

Process 1-4

A benzyloxypyrazole derivative represented by the above general formula (XI) can be prepared by condensing a compound

represented by the above general formula (X) with a hydrazine compound represented by the above general formula (VII) or a monohydrate thereof, or a salt thereof in the presence of a base such as triethylamine or *N*,*N*-diisopropylethylamine in an inert solvent, and introducing a hydrogen-protective in usual way as occasion demands. As the inert solvent used in the condensing reaction, for example, acetonitrile and the like can be illustrated. The reaction temperature is usually from 0°C to reflux temperature, and the reaction time is usually from 1 hour to 1 day, varying based on a used starting material, solvent and reaction temperature.

Process 1-5

A pyrazole aldehyde derivative represented by the above general formula (XII) can be prepared by subjecting a compound represented by the above general formula (XI) to Vilsmeier reaction using phosphorus oxychloride and *N*,*N*-dimethyl-formamide in a various solvent. As the solvent used in the reacion, for example, *N*,*N*-dimethylformamide and the like can be illustrated. The reaction temperature is usually from 0°C to reflux temperature, and the reaction time is usually from 30 minutes to 1 day, varying based on a used starting material, solvent and reaction temperature.

Process 1-6

A compound represented by the above general formula (XIV) can be prepared by condensing a compound represented by the above general formula (XII) with a Grignard reagent, a Reformatsky reagent or a lithium reagent represented by the above general

formula (XIII) in an inert solvent. As the solvent used in the reaction, for example, tetrahydrofuran, diethyl ether, a mixed solvent thereof and the like can be illustrated. The reaction temperature is usually from -78°C to room temperature, and the reaction time is usually from 30 minutes to 1 day, varying based on a used starting material, solvent and reaction temperature.

Process 1-7

A benzylpyrazole derivative represented by the above general formula (III) can be prepared by subjecting a compound represented by the above general formula (XIV) to catalytic hydrogenation using a palladium catalyst such as palladium-carbon powder in the presence or absence of an acid such as hydrochloric acid in an inert solvent, and in a case of a compound having any sulfur atom represented by the above general formula (XIV), subjecting the resulting compound to acid treatment in an aqueous solution of trifluoroacetic acid and dimethyl sulfide usually at 0°C to reflux temperature for 30 minutes to 1 day as occasion demands. As the solvent used in the catalytic hydrogenation, for example, methanol, ethanol, tetrahydrofuran, ethyl acetate, acetic acid, isopropanol, a mixed solvent thereof and the like can be illustrated. The reaction temperature is usually from room temperature to reflux temperature, and the reaction time is usually from 30 minutes to 1 day, varying based on a used starting material, solvent and reaction temperature. The obtained benzylpyrazole derivative represented by the above general formula (III) can be also used in the subsequent process after suitably converting

into a salt thereof in the usual way.

Process 1-8

[1] In case that one of Q^3 and T^3 is a C_{1-6} alkyl group, a C_{1-6} alkoxy-substituted (C_{1-6} alkyl) group or a C_{3-7} cycloalkyl group in a benzylpyrazole derivative represented by the above general formula (III), a corresponding compound represented by the above general formula (II) of the present invention can be prepared by subjecting a corresponding benzylpyrazole derivative represented by the above general formula (III) to glycosidation using acetobromo-α-D-glucose or acetobromo-α-D-galactose in the presence of a base such as silver carbonate, sodium hydride or the like in an inert solvent. As the inert solvent used in the reaction, for example, tetrahydrofuran, dimethoxyethane, *N,N*-dimethylformamide, a mixed solvent thereof and the like can be illustrated. The reaction temperature is usually from room temperature to reflux temperature, and the reaction time is usually from 1 hour to 1 day, varying based on a used starting material, solvent and reaction temperature.

[2] In case that one of Q^3 and T^3 is a halo(C_{1-6} alkyl) group in a benzylpyrazole derivative represented by the above general formula (III), a corresponding compound represented by the above general formula (II) of the present invention can be prepared by subjecting a corresponding benzylpyrazole derivative represented by the above general formula (III) to glycosidation using acetobromo-α-D-glucose or acetobromo-α-D-galactose in the presence of a base such as potassium carbonate or the like in an inert solvent. As the inert solvent used in the reaction,

for example, tetrahydrofuran, acetonitrile, a mixed solvent thereof and the like can be illustrated. The reaction temperature is usually from room temperature to reflux temperature, and the reaction time is usually from 1 hour to 1 day, varying based on a used starting material, solvent and reaction temperature.

[3] In case that one of Q^3 and T^3 is a C_{2-6} alkyl group, a C_{1-6} alkoxy-substituted (C_{1-6} alkyl) group or a C_{3-7} cycloalkyl group in a benzylpyrazole derivative represented by the above general formula (III), a corresponding compound represented by the above general formula (II) of the present invention can be also prepared by subjecting a corresponding benzylpyrazole derivative represented by the above general formula (III) to glycosidation using acetobromo-α-D-glucose or acetobromo-α-D-galactose in the presence of a base such as sodium hydroxide, potassium hydroxide, potassium carbonate or the like and a phase transfer catalyst such as benzyltri(*n*-butyl)ammonium chloride, benzyltri(*n*-butyl)ammonium bromide, tetra(*n*-butyl)ammonium hydrogen sulfate or the like in an inert solvent containing water. As the inert solvent used in the reaction, dichloromethane, toluene, benzotrifluoride, a mixed solvent thereof and the like can be illustrated. The reaction temperature is usually from 0°C to reflux temperature, and the reaction time is usually from 30 minutes to 1 day, varying based on a used starting material, solvent and reaction temperature.

The obtained glycosidated benzylpyrazole derivative represented by the above general formula (II) can be also used

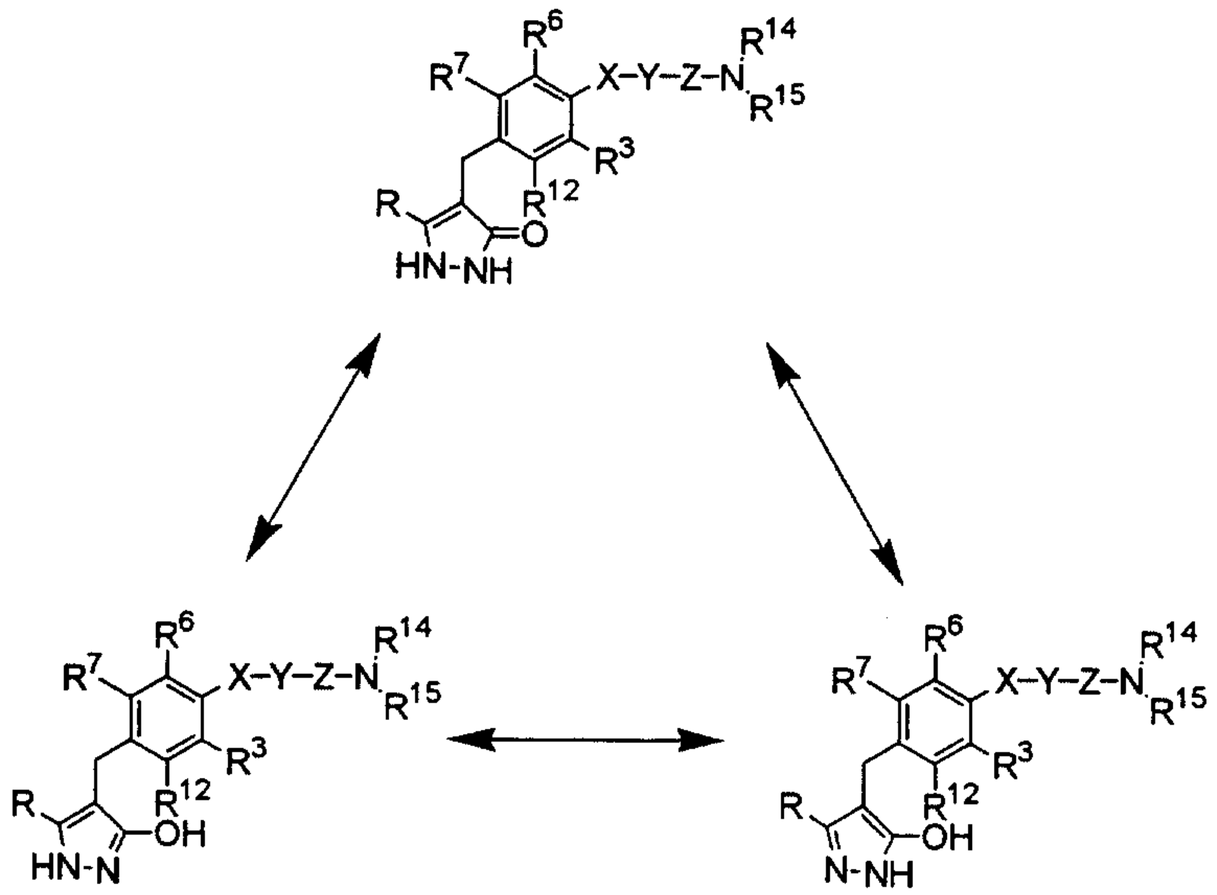
in the subsequent process after suitably converting into a salt thereof and separating in the usual way.

Process 1-9

A pyrazole derivative represented by the above general formula (I) of the present invention can be prepared by subjecting a compound represented by the above general formula (II) to alkaline hydrolysis, and removing a protective group or subjecting a nitro group of the resulting compound to reduction as occasion demands. As the solvent used in the hydrolysis reaction, for example, methanol, ethanol, tetrahydrofuran, water, a mixed solvent thereof and the like can be illustrated. As the base, for example, sodium hydroxide, sodium methoxide, sodium ethoxide and the like can be illustrated. The reaction temperature is usually from 0°C to reflux temperature, and the reaction time is usually from 30 minutes to 1 day, varying based on a used starting material, solvent and reaction temperature. As mentioned above, in case of compounds having a protective group in R^{11}, R^{12}, R^{14} and/or R^{15} after the hydrolysis, the protective group can be suitably removed in the usual way. Furthermore, after the completion of the above reaction, compounds having a nitro group in R^2 represented by the above general formula (I) can be also derived into a corresponding compound having an amino group by catalytic reduction using a platinum catalyst such as platinum oxide in an inert solvent such as ethyl acetate at usually room temperature to reflux temperature for usually 30 minutes to 1 day in the usual way.

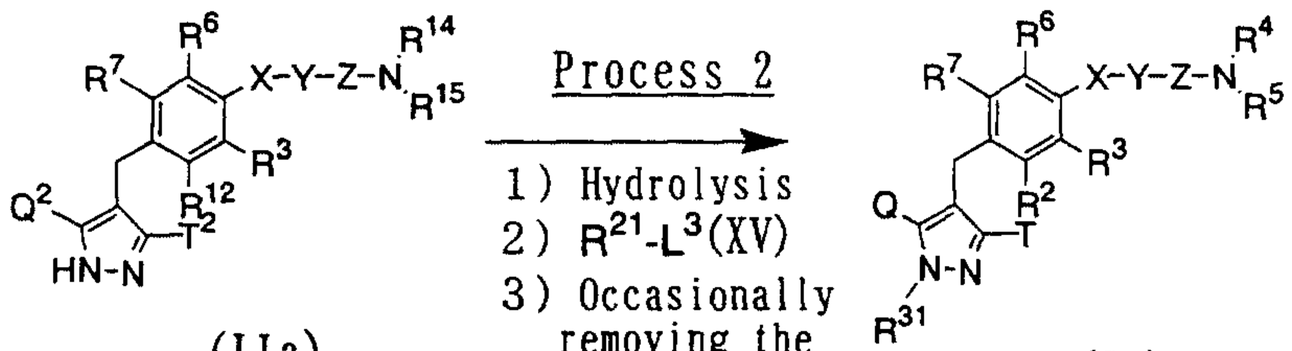
Among the compounds represented by the above general

formula (III) as starting materials, there can be the following three tautomers in compounds wherein R^{11} is a hydrogen atom, varying based on difference in the reaction conditions, and the compounds represented by the above general formula (III) include all the compounds:



wherein R, R^3, R^6, R^7, R^{12}, R^{14}, R^{15}, X, Y and Z have the same meanings as defined above.

Of the compounds represented by the above general formula (I) of the present invention, a compound wherein R^1 represents a C_{1-6} alkyl group, a C_{2-6} alkenyl group, a hydroxy(C_{2-6} alkyl) group, a C_{3-7} cycloalkyl group, a C_{3-7} cycloalkyl-substituted (C_{1-6} alkyl) group or an aryl-substituted (C_{1-6} alkyl) group which may have the same or different 1 to 3 substituents selected from the group consisting of a halogen atom, a hydroxy group, an amino group, a C_{1-6} alkyl group and a C_{1-6} alkoxy group, for example, can be prepared according to the following procedure:



(IIa) (Ia)

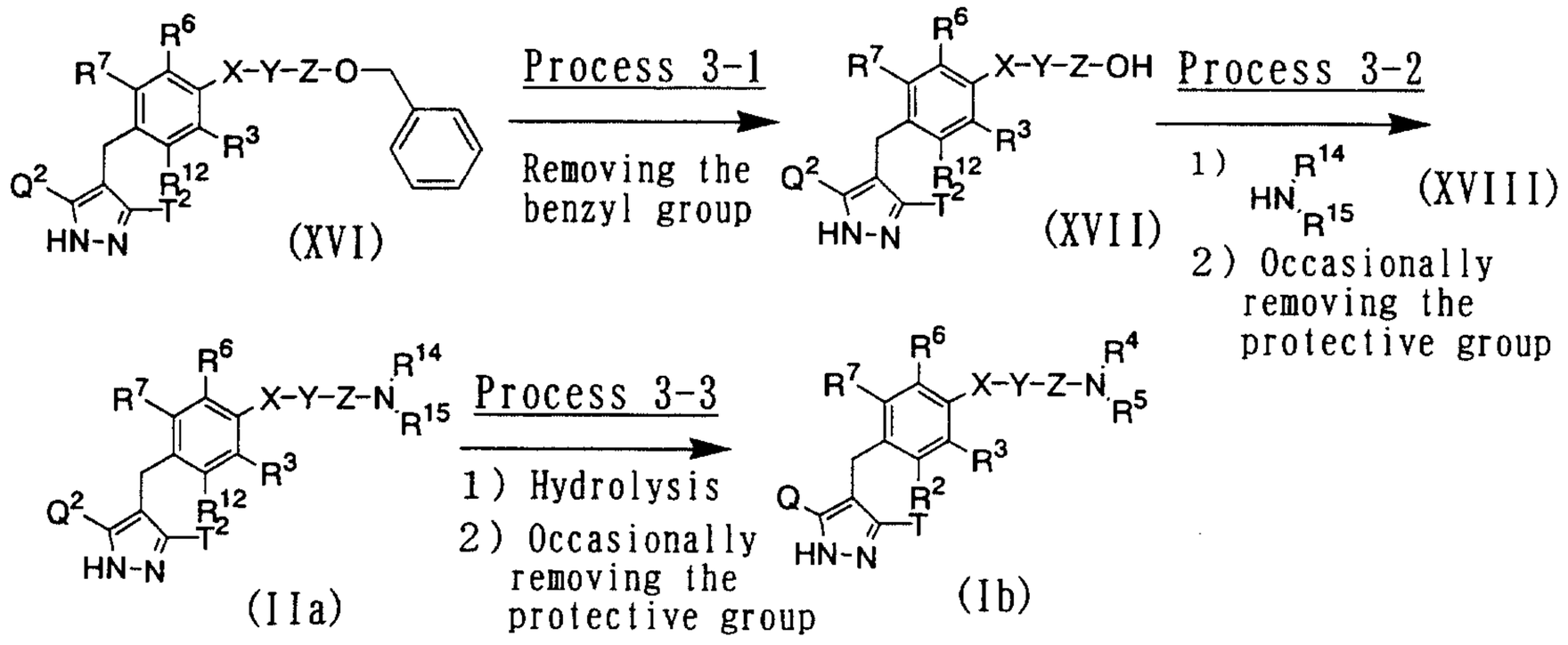
wherein L^3 represents a leaving group such as a halogen atom, a mesyloxy group, a tosyloxy group or the like; R^{21} represents a C_{1-6} alkyl group, a C_{2-6} alkenyl group, a hydroxy(C_{2-6} alkyl) group which may have a protective group, a C_{3-7} cycloalkyl group, a C_{3-7} cycloalkyl-substituted (C_{1-6} alkyl) group or an aryl-substituted (C_{1-6} alkyl) group which may have the same or different 1 to 3 substituents selected from the group consisting of a halogen atom, a hydroxy group which may have a protective group, an amino group which may have a protective group, a C_{1-6} alkyl group and a C_{1-6} alkoxy group; R^{31} represents a C_{1-6} alkyl group, a C_{2-6} alkenyl group, a hydroxy(C_{2-6} alkyl) group, a C_{3-7} cycloalkyl group, a C_{3-7} cycloalkyl-substituted (C_{1-6} alkyl) group or an aryl-substituted (C_{1-6} alkyl) group which may have the same or different 1 to 3 substituents selected from the group consisting of a halogen atom, a hydroxy group, an amino group, a C_{1-6} alkyl group and a C_{1-6} alkoxy group; and R^2, R^3, R^4, R^5, R^6, R^7, R^{12}, R^{14}, R^{15}, Q, Q^2, T, T^2, X, Y and Z have the same meanings as defined above.

Process 2

A pyrazole derivative represented by the above general formula (Ia) of the present invention can be prepared by subjecting a compound represented by the above general formula

(IIa) to hydrolysis according to a similar method to that described in the above process 1-9 and *N*-alkylation using an *N*-alkylating agent represented by the above general formula (XV) in the presence of a base such as cesium carbonate or potassium carbonate in an inert solvent, and in case of compounds having a protective group, suitably removing the protective group in the usual way as occasion demands. As the inert solvent used in the *N*-alkylation, for example, acetonitrile, ethanol, 1,2-dimethoxyethane, tetrahydrofuran, *N*,*N*-dimethylformamide, dimethyl sulfoxide, a mixed solvent thereof and the like can be illustrated. The reaction temperature is usually from room temperature to reflux temperature, and the reaction time is usually from 10 minutes to 1 day, varying based on a used starting material, solvent and reaction temperature.

Of the compounds represented by the above general formula (I) of the present invention, a compound wherein R^1 represents a hydrogen atom, for example, can be also prepared according to the following procedure:



wherein R^2, R^3, R^4, R^5, R^6, R^7, R^{12}, R^{14}, R^{15}, Q, Q^2, T, T^2, X, Y and Z have the same meanings as defined above.

Process 3-1

A compound represented by the above general formula (XVII) can be prepared by subjecting a compound represented by the above general formula (XVI) to catalytic hydrogenation using a palladium catalyst such as palladium-carbon powder in an inert solvent to remove the benzyl group. As the solvent used in the catalytic hydrogenation, for example, methanol, ethanol, tetrahydrofuran, ethyl acetate, a mixed solvent thereof and the like can be illustrated. The reaction temperature is usually from 0°C to reflux temperature, and the reaction time is usually from 1 hour to 2 days, varying based on a used starting material, solvent and reaction temperature.

Process 3-2

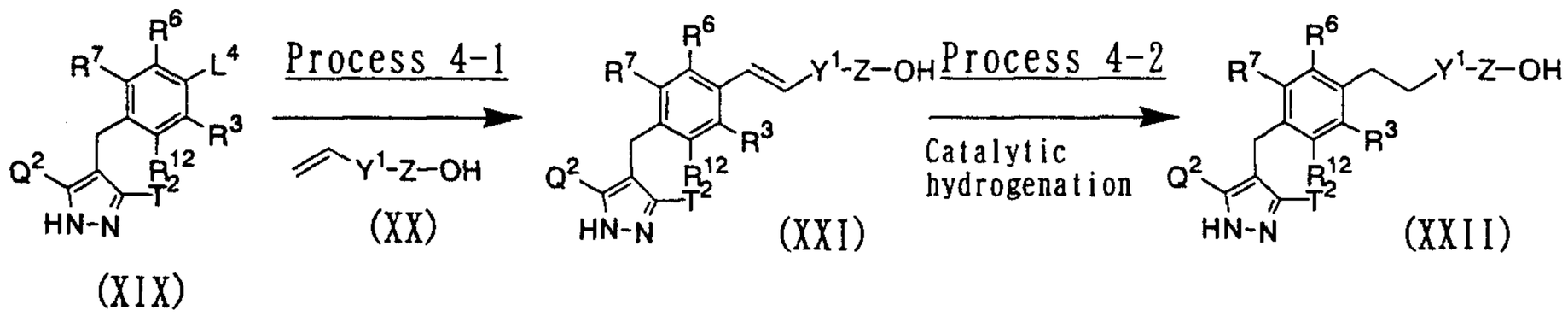
A compound represented by the above general formula (IIa) of the present invention can be prepared by condensing a compound represented by the above general formula (XVII) with an amine derivative represented by the above general formula (XVIII) in the presence of a condensing agent such as 1-ethyl-3-(3-dimethylaminopropyl)carbodiimide hydrochloride or dicyclohexylcarbodiimide and in the presence or absence of a base such as triethylamine or *N*,*N*-diisopropylethylamine in an inert solvent after suitably adding 1-hydroxybenzotriazole as occasion demands. As the solvent used in the condensing reaction, for example, *N*,*N*-dimethylformamide, dichloromethane, tetrahydrofuran, a mixed solvent thereof and the like can be illustrated. The reaction temperature is usually from 0°C to reflux temperature, and the reaction time is usually from 1 hour

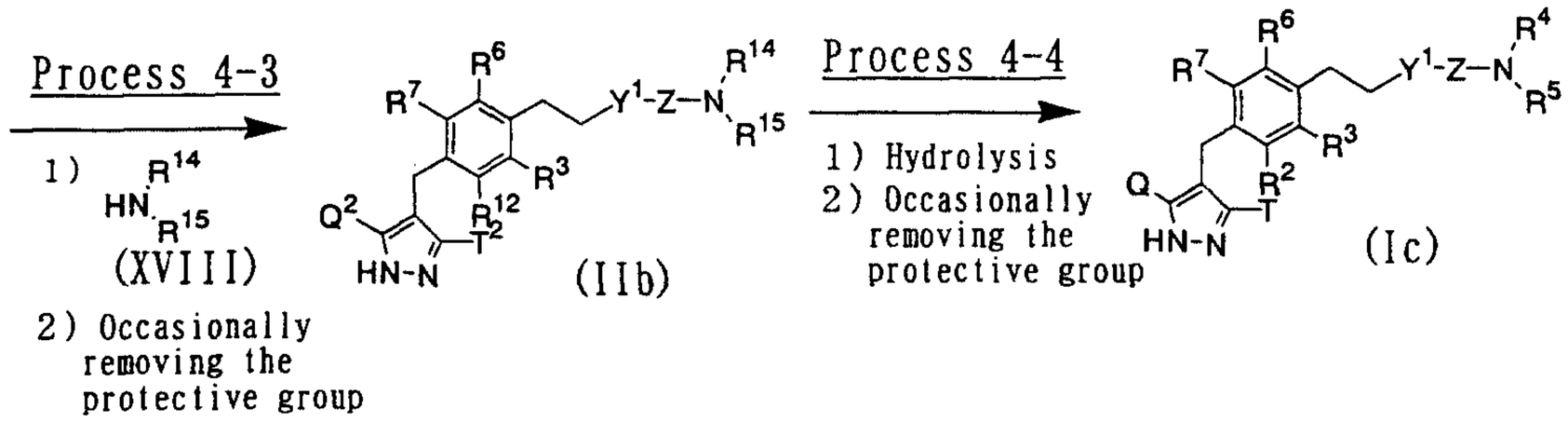
to 2 days, varying based on a used starting material, solvent and reaction temperature.

Process 3-3

A pyrazole derivative represented by the above general formula (Ib) of the present invention can be prepared by subjecting a compound represented by the above general formula (IIa) to alkaline hydrolysis, and removing the protective group in the usual way as occasion demands. As the solvent used in the hydrolysis reaction, for example, methanol, ethanol, tetrahydrofuran, water, a mixed solvent thereof and the like can be illustrated. As the base, for example, sodium hydroxide, sodium methoxide, sodium ethoxide and the like can be illustrated. The reaction temperature is usually from 0°C to reflux temperature, and the reaction time is usually from 30 minutes to 1 day, varying based on a used starting material, solvent and reaction temperature. In case of compounds having a protective group in R^{12}, R^{14} and/or R^{15} after the hydrolysis, the protective group can be suitably removed in the usual way as the process 1-9.

Of the compounds represented by the above general formula (I) of the present invention, a compound wherein R^1 represents a hydrogen atom; X represents a single bond; and Y represents a C_{2-6} alkylene group or a C_{2-6} alkenylene group, for example, can be prepared according to the following procedures:





wherein L^4 represents a leaving group such as a chlorine atom, a bromine atom, an iodine atom, a trifluoromethanesulfonyloxy group or the like; Y^1 represents a single bond or a C_{1-4} alkylene group; and R^2, R^3, R^4, R^5, R^6, R^7, R^{12}, R^{14}, R^{15}, Q, Q^2, T, T^2 and Z have the same meanings as defined above.

Process 4-1

A pyrazole derivative represented by the above general formula (XXI) can be prepared by subjecting a pyrazole derivative represented by the above general formula (XIX) to Heck reaction with an olefine derivative represented by the above general formula (XX) using a palladium catalyst such as palladium-carbon powder, palladium acetate, tetrakis(triphenylphosphine)-palladium, dibenzylideneacetonepalladium or bis(triphenyl-phosphine)palladium dichloride in the presence or absence of a phosphine ligand such as tris(2-methylphenyl)phosphine or triphenylphosphine and in the presence of a base such as triethylamine, sodium *tert*-butoxide, potassium *tert*-butoxide or cesium fluoride in an inert solvent. As the solvent used in the reaction, for example, acetonitrile, toluene,

tetrahydrofuran, a mixed solvent thereof and the like can be illustrated. The reaction temperature is usually from 0°C to reflux temperature, and the reaction time is usually from 1 hour to 2 days, varying based on a used starting material, solvent and reaction temperature.

Process 4-2

A compound represented by the above general formula (XXII) can be prepared by subjecting a compound represented by the above general formula (XXI) to catalytic hydrogenation using a palladium catalyst such as palladium-carbon powder in an inert solvent. As the solvent used in the catalytic hydrogenation, for example, methanol, ethanol, tetrahydrofuran, ethyl acetate, a mixed solvent thereof and the like can be illustrated. The reaction temperature is usually from 0°C to reflux temperature, and the reaction time is usually from 1 hour to 2 days, varying based on a used starting material, solvent and reaction temperature.

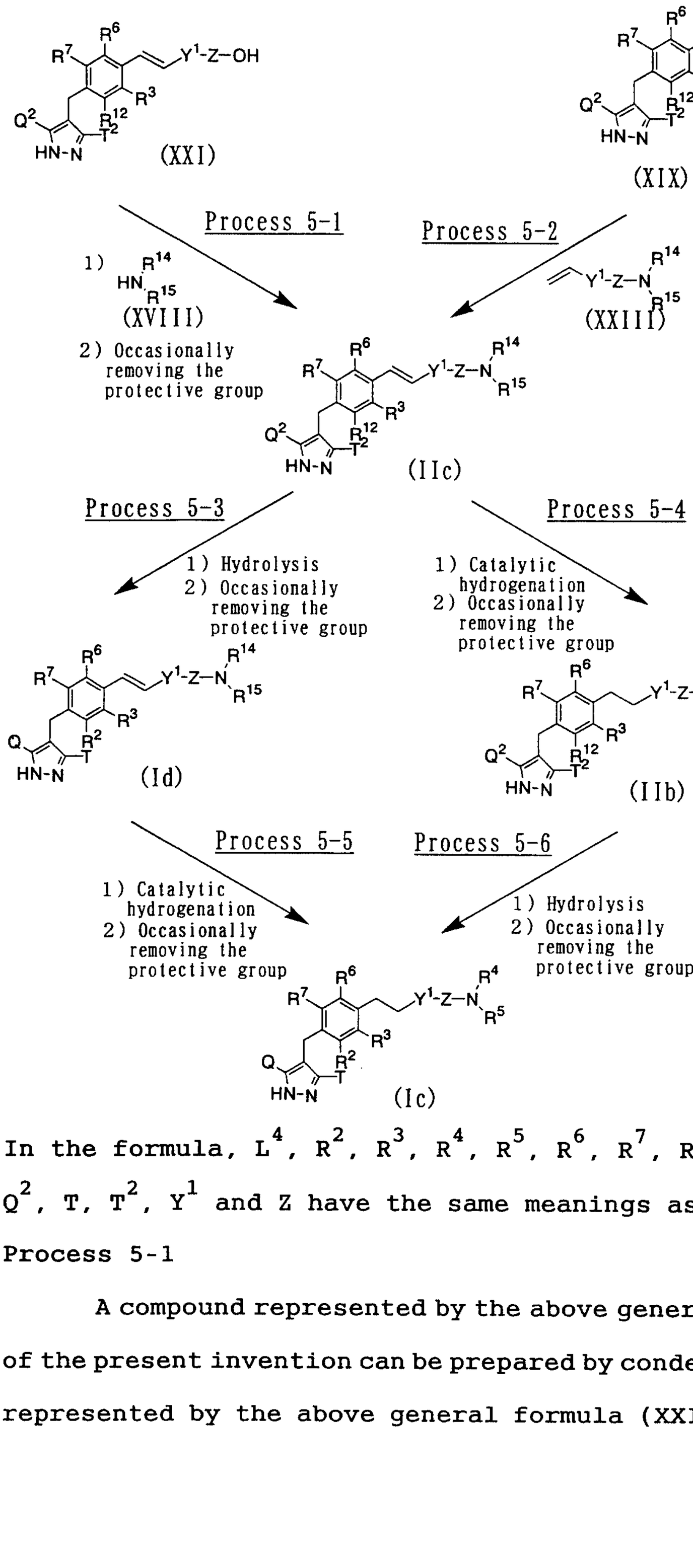
Process 4-3

A compound represented by the above general formula (IIb) of the present invention can be prepared by condensing a compound represented by the above general formula (XXII) with an amine derivative represented by the above general formula (XVIII) in the presence of a condensing agent such as 1-ethyl-3-(3-dimethyl-aminopropyl)carbodiimide hydrochloride or dicyclohexyl-carbodiimide and a base such as triethylamine or *N*,*N*-diisopropyl-ethylamine in an inert solvent after suitably adding 1-hydroxy-benzotriazole as occasion demands, and suitably removing the

protective group in the usual way as occasion demands. As the solvent used in the condensing reaction, for example, *N*,*N*-dimethylformamide, dichloromethane, tetrahydrofuran, a mixed solvent thereof and the like can be illustrated. The reaction temperature is usually from 0°C to reflux temperature, and the reaction time is usually from 1 hour to 2 days, varying based on a used starting material, solvent and reaction temperature.

Process 4-4

A pyrazole derivative represented by the above general formula (Ic) of the present invention can be prepared by subjecting a compound represented by the above general formula (IIb) to alkaline hydrolysis, and suitably removing the protective group in the usual way as occasion demands. As the solvent used in the hydrolysis reaction, for example, methanol, ethanol, tetrahydrofuran, water, a mixed solvent thereof and the like can be illustrated. As the base, for example, sodium hydroxide, sodium methoxide, sodium ethoxide and the like can be illustrated. The reaction temperature is usually from 0°C to reflux temperature, and the reaction time is usually from 30 minutes to 1 day, varying based on a used starting material, solvent and reaction temperature. In case of compounds having a protective group in R^{12}, R^{14} and/or R^{15} after the hydrolysis, the protective group can be suitably removed in the usual way as the process 1-9.



In the formula, L^4, R^2, R^3, R^4, R^5, R^6, R^7, R^{12}, R^{14}, R^{15}, Q, Q^2, T, T^2, Y^1 and Z have the same meanings as defined above.

Process 5-1

A compound represented by the above general formula (IIc) of the present invention can be prepared by condensing a compound represented by the above general formula (XXI) with an amine

derivative represented by the above general formula (XVIII) in the presence of a condensing agent such as 1-ethyl-3-(3-dimethylaminopropyl)carbodiimide hydrochloride or dicyclohexylcarbodiimide and a base such as triethylamine or *N*,*N*-diisopropylethylamine in an inert solvent after suitably adding 1-hydroxybenzotriazole as occasion demands, and suitably removing the protective group in the usual way as occasion demands. As the solvent used in the condensing reaction, for example, *N*,*N*-dimethylformamide, dichloromethane, tetrahydrofuran, a mixed solvent thereof and the like can be illustrated. The reaction temperature is usually from 0°C to reflux temperature, and the reaction time is usually from 1 hour to 2 days, varying based on a used starting material, solvent and reaction temperature.

Process 5-2

A pyrazole derivative represented by the above general formula (IIc) of the present invention can be prepared by subjecting a pyrazole derivative represented by the above general formula (XIX) to Heck reaction with an olefine derivative represented by the above general formula (XXIII) using a palladium catalyst such as palladium-carbon powder, palladium acetate, tetrakis(triphenylphosphine)palladium, dibenzylideneacetonepalladium or bis(triphenylphosphine)-palladium dichloride in the presence or absence of a phosphine ligand such as tris(2-methylphenyl)phosphine or triphenylphosphine and in the presence of a base such as triethylamine, sodium *tert*-butoxide, potassium *tert*-butoxide or cesium

fluoride in an inert solvent. As the solvent used in the reaction, for example, acetonitrile, toluene, tetrahydrofuran, a mixed solvent thereof and the like can be illustrated. The reaction temperature is usually from 0°C to reflux temperature, and the reaction time is usually from 1 hour to 2 days, varying based on a used starting material, solvent and reaction temperature.

Process 5-3

A pyrazole derivative represented by the above general formula (Id) of the present invention can be prepared by subjecting a compound represented by the above general formula (IIc) to alkaline hydrolysis, and suitably removing the protective group in the usual way as occasion demands. As the solvent used in the hydrolysis reaction, for example, methanol, ethanol, tetrahydrofuran, water, a mixed solvent thereof and the like can be illustrated. As the base, for example, sodium hydroxide, sodium methoxide, sodium ethoxide and the like can be illustrated. The reaction temperature is usually from 0°C to reflux temperature, and the reaction time is usually from 30 minutes to 1 day, varying based on a used starting material, solvent and reaction temperature. In case of compounds having a protective group in R^{12}, R^{14} and/or R^{15} after the hydrolysis, the protective group can be suitably removed in the usual way as the process 1-9.

Process 5-4

A compound represented by the above general formula (IIb) can be prepared by subjecting a compound represented by the above general formula (IIc) to catalytic hydrogenation using a

palladium catalyst such as palladium-carbon powder in an inert solvent. As the solvent used in the catalytic hydrogenation, for example, methanol, ethanol, tetrahydrofuran, ethyl acetate, a mixed solvent thereof and the like can be illustrated. The reaction temperature is usually from 0°C to reflux temperature, and the reaction time is usually from 1 hour to 2 days, varying based on a used starting material, solvent and reaction temperature.

Process 5-5

A compound represented by the above general formula (Ic) of the present invention can be prepared by subjecting a compound represented by the above general formula (Id) to catalytic hydrogenation using a palladium catalyst such as palladium-carbon powder in an inert solvent. As the solvent used in the catalytic hydrogenation, for example, methanol, ethanol, tetrahydrofuran, ethyl acetate, a mixed solvent thereof and the like can be illustrated. The reaction temperature is usually from 0°C to reflux temperature, and the reaction time is usually from 1 hour to 2 days, varying based on a used starting material, solvent and reaction temperature.

Process 5-6

A pyrazole derivative represented by the above general formula (Ic) of the present invention can be prepared by subjecting a compound represented by the above general formula (IIb) to alkaline hydrolysis, and suitably removing the protective group in the usual way as occasion demands. As the solvent used in the hydrolysis reaction, for example, methanol,

ethanol, tetrahydrofuran, water, a mixed solvent thereof and the like can be illustrated. As the base, for example, sodium hydroxide, sodium methoxide, sodium ethoxide and the like can be illustrated. The reaction temperature is usually from 0°C to reflux temperature, and the reaction time is usually from 30 minutes to 1 day, varying based on a used starting material, solvent and reaction temperature. In case of compounds having a protective group in R^{12}, R^{14} and/or R^{15} after the hydrolysis, the protective group can be suitably removed in the usual way as the process 1-9.

The compounds represented by the above general formula (I) of the present invention obtained by the above production processes can be isolated and purified by conventional separation means such as fractional recrystallization, purification using chromatography, solvent extraction and solid phase extraction.

The pyrazole derivatives represented by the above general formula (I) of the present invention can be converted into their pharmaceutically acceptable salts in the usual way. Examples of such salts include acid addition salts with mineral acids such as hydrochloric acid, hydrobromic acid, hydroiodic acid, sulfuric acid, nitric acid, phosphoric acid and the like, acid addition salts with organic acids such as formic acid, acetic acid, methanesulfonic acid, benzenesulfonic acid, *p*-toluenesulfonic acid, propionic acid, citric acid, succinic acid, tartaric acid, fumaric acid, butyric acid, oxalic acid, malonic acid, maleic acid, lactic acid, malic acid, carbonic acid, glutamic acid, aspartic acid and the like, salts with

inorganic bases such as a sodium salt, a potassium salt and the like, and salts with organic bases such as *N*-methyl-D-glucamine, *N*,*N*'-dibenzyletylenediamine, 2-aminoethanol, tris(hydroxymethyl)aminomethane, arginine, lysine and the like.

The compounds represented by the above general formula (I) of the present invention include their solvates with pharmaceutically acceptable solvents such as ethanol and water.

Of the pyrazole derivatives represented by the above general formula (I) of the present invention and the prodrugs thereof, there are two geometrical isomers in each compound having an unsaturated bond. In the present invention, either of cis(*Z*)-isomer or trans(*E*)-isomer can be employed.

Of the pyrazole derivatives represented by the above general formula (I) of the present invention and the prodrugs thereof, there are two optical isomers, *R*-isomer and *S*-isomer, in each compound having an asymmetric carbon atom excluding the glucopyranosyloxy moiety or the galactopyranosyloxy moiety. In the present invention, either of the isomers can be employed, and a mixture of both isomers can be also employed.

A prodrug of a compound represented by the above general formula (I) of the present invention can be prepared by introducing an appropriate group forming a prodrug into any one or more groups selected from a hydroxy group in the glucopyranosyl moiety or the galactopyranosyl moiety, or optionally in R^1, R^2, R^4 or R^5, a cyclic amino group in case that R^1 is a hydrogen atom, and an amino group in case that R^1, R^2, R^4 or R^5 is a substituent having an amino group of the compound represented

by the above general formula (I) using a corresponding reagent to produce a prodrug such as a halide compound or the like in the usual way, and then by suitably isolating and purificating in the usual way as occasion demands. As a group forming a prodrug used in a hydroxy group or an amino group, for example, a C_{2-7} acyl group, a C_{1-6} alkoxy-substituted (C_{2-7} acyl) group, a C_{2-7} alkoxycarbonyl-substituted (C_{2-7} acyl) group, a C_{2-7} alkoxycarbonyl group, an aryl-substituted (C_{2-7} alkoxycarbonyl) group, a C_{1-6} alkoxy-substituted (C_{2-7} alkoxycarbonyl) group or the like can be illustrated. As a group forming a prodrug used in a cyclic amino group, for example, a C_{2-7} acyl group, a C_{1-6} alkoxy-substituted (C_{2-7} acyl) group, a C_{2-7} alkoxycarbonyl-substituted (C_{2-7} acyl) group, a C_{2-7} alkoxycarbonyl group, a C_{1-6} alkoxy-substituted (C_{2-7} alkoxycarbonyl) group, a (C_{2-7} acyloxy)methyl group, a 1-(C_{2-7} acyloxy)ethyl group, a (C_{2-7} alkoxycarbonyl)oxymethyl group, a 1-[(C_{2-7} alkoxycarbonyl)oxy]ethyl group, a (C_{3-7} cycloalkyl)oxycarbonyloxymethyl group, a 1-[(C_{3-7} cycloalkyl)-oxycarbonyloxy]ethyl group or the like can be illustrated. The term "C_{2-7} acyl group" means a straight-chained or branched acyl group having 2 to 7 carbon atoms such as an acetyl group, a propionyl group, a butyryl group, an isobutyryl group, a valeryl group, a pivaloyl group, a hexanoyl group or the like; and the term "C_{1-6} alkoxy-substituted (C_{2-7} acyl) group" means the above C_{2-7} acyl group substituted by the above C_{1-6} alkoxy group; the term "C_{2-7} alkoxycarbonyl-substituted (C_{2-7} acyl) group" means the above C_{2-7} acyl group substituted by the above C_{2-7}

alkoxycarbonyl group; the term "aryl-substituted (C_{2-7} alkoxycarbonyl) group" means the above C_{2-7} alkoxycarbonyl group substituted by the above aryl group, such as a benzyloxycarbonyl group; the term "C_{1-6} alkoxy-substituted (C_{2-7} alkoxycarbonyl) group" means the above C_{2-7} alkoxycarbonyl group substituted by the above C_{1-6} alkoxy group; the term "(C_{2-7} acyloxy)methyl group" means a hydroxymethyl group *O*-substituted by the above C_{2-7} acyl group; the term "1-(C_{2-7} acyloxy)ethyl group" means a 1-hydroxyethyl group *O*-substituted by the above C_{2-7} acyl group; the term "(C_{2-7} alkoxycarbonyl)oxymethyl group" means a hydroxymethyl group substituted by the above C_{2-7} alkoxycarbonyl group; and the term "1-[(C_{2-7} alkoxycarbonyl)oxy]ethyl group" means a 1-hydroxyethyl group *O*-substituted by the above C_{2-7} alkoxycarbonyl group. In addition, the term "(C_{3-7} cycloalkyl)oxycarbonyl group" means a cyclic alkoxycarbonyl group having the above C_{3-7} cycloalkyl group; the term "(C_{3-7} cycloalkyl)oxycarbonyloxymethyl group" means a hydroxymethyl group *O*-substituted by the above (C_{3-7} cycloalkyl)oxycarbonyl group; and the term "1-[(C_{3-7} cycloalkyl)oxycarbonyloxy]ethyl group" means a 1-hydroxyethyl group *O*-substituted by the above (C_{3-7} cycloalkyl)oxycarbonyl group. Furthermore, as a group forming a prodrug, a glucopyranosyl group or a galactopyranosyl group can be illustrated. For example, these groups are preferably introduced into the hydroxy group at the 4 or 6 position of the glucopyranosyl group or the galactopyranosyl group, and are more preferably introduced into the hydroxy group at the 4 or 6 position of the glucopyranosyl group.

The pyrazole derivatives represented by the above general formula (I) of the present invention, for example, showed a potent inhibitory activity in human SGLT1 in a human SGLT1 inhibitory activity confirmatory test as described below, and exerted an excellent inhibitory activity of blood glucose level increase in a confirmatory test of the inhibitory activity of blood glucose level increase in rat. Thus, the pyrazole derivatives represented by the above general formula (I) of the present invention exhibit an excellent SGLT1 inhibitory activity at the small intestine, and can remarkably inhibit blood glucose level increase and/or decrease blood galactose level by inhibiting or delaying glucose and galactose absorption. Therefore, a pharmaceutical composition comprising as an active ingredient a pyrazole derivative represented by the above general formula (I) of the present invention, a pharmaceutically acceptable salt and a prodrug thereof is extremely useful as an agent for inhibiting postprandial hypreglycemia, an agent for the inhibition of advancing impaired glucose tolerance (IGT) or impaired fasting glycemia (IFG) into diabetes in a subject, and an agent for the prevention or treatment of a disease associated with hyperglycemia such as diabetes, impaired glucose tolerance, impaired fasting glycemia, diabetic complications (e.g., retinopathy, neuropathy, nephropathy, ulcer, macroangiopathy), obesity, hyperinsulinemia, hyperlipidemia, hypercholesterolemia, hypertriglyceridemia, lipid metabolism disorder, atherosclerosis, hypertension, congestive heart failure, edema, hyperuricemia, gout or the like, which relates

to SGLT1 activity at the small intestine, and an agent for the prevention or treatment of a disease associated with increasing blood galactose level such as galactosemia.

Furthermore, the compounds of the present invention can be suitably used in combination with at least one member selected from drugs other than SGLT2 inhibitors. Examples of the drugs which can be used in combination with the compounds of the present invention include an insulin sensitivity enhancer, a glucose absorption inhibitor, a biguanide, an insulin secretion enhancer, a SGLT2 inhibitor, an insulin or insulin analogue, a glucagon receptor antagonist, an insulin receptor kinase stimulant, a tripeptidyl peptidase II inhibitor, a dipeptidyl peptidase IV inhibitor, a protein tyrosine phosphatase-1B inhibitor, a glycogen phosphorylase inhibitor, a glucose-6-phosphatase inhibitor, a fructose-bisphosphatase inhibitor, a pyruvate dehydrogenase inhibitor, a hepatic gluconeogenesis inhibitor, D-chiroinsitol, a glycogen synthase kinase-3 inhibitor, glucagon-like peptide-1, a glucagon-like peptide-1 analogue, a glucagon-like peptide-1 agonist, amylin, an amylin analogue, an amylin agonist, an aldose reductase inhibitor, an advanced glycation endproducts formation inhibitor, a protein kinase C inhibitor, a γ-aminobutyric acid receptor antagonist, a sodium channel antagonist, a transcript factor NF-κB inhibitor, a lipid peroxidase inhibitor, an *N*-acetylated-α-linked-acid-dipeptidase inhibitor, insulin-like growth factor-I, platelet-derived growth factor (PDGF), a platelet-derived growth factor (PDGF) analogue (e.g., PDGF-AA, PDGF-BB, PDGF-AB),

epidermal growth factor (EGF), nerve growth factor, a carnitine derivative, uridine, 5-hydroxy-1-methylhidantoin, EGB-761, bimoclomol, sulodexide, Y-128, antidiarrhoics, cathartics, a hydroxymethylglutaryl coenzyme A reductase inhibitor, a fibric acid derivative, a β_3-adrenoceptor agonist, an acyl-coenzyme A cholesterol acyltransferase inhibitor, probcol, a thyroid hormone receptor agonist, a cholesterol absorption inhibitor, a lipase inhibitor, a microsomal triglyceride transfer protein inhibitor, a lipoxygenase inhibitor, a carnitine palmitoyltransferase inhibitor, a squalene synthase inhibitor, a low-density lipoprotein receptor enhancer, a nicotinic acid derivative, a bile acid sequestrant, a sodium/bile acid cotransporter inhibitor, a cholesterol ester transfer protein inhibitor, an appetite suppressant, an angiotensin-converting enzyme inhibitor, a neutral endopeptidase inhibitor, an angiotensin II receptor antagonist, an endothelin-converting enzyme inhibitor, an endothelin receptor antagonist, a diuretic agent, a calcium antagonist, a vasodilating antihypertensive agent, a sympathetic blocking agent, a centrally acting antihypertensive agent, an α_2-adrenoceptor agonist, an antiplatelets agent, a uric acid synthesis inhibitor, a uricosuric agent and a urinary alkalinizer.

In case of uses of the compound of the present invention in combination with the above one or more drugs, the present invention includes either dosage forms of simultaneous administration as a single preparation or separated praparations in way of the same or different administration route, and

administration at different dosage intervals as separated praparations in way of the same or different administration route. A pharmaceutical combination comprising the compound of the present invention and the above drug(s) includes both dosage forms as a single preparation and separated preparations for combination as mentioned above.

The compounds of the present invention can obtain more advantageous effects than additive effects in the prevention or treatment of the above diseases when using suitably in combination with the above one or more drugs. Also, the administration dose can be decreased in comparison with administration of either drug alone, or adverse effects of coadministrated drugs other than SGLT1 inhibitors can be avoided or declined.

Concrete compounds as the drugs used for combination and preferable diseases to be treated are exemplified as follows. However, the present invention is not limited thereto, and the concrete compounds include their free compounds, and their or other pharmaceutically acceptable salts.

As insulin sensitivity enhancers, peroxisome proliferator-activated receptor-γ agonists such as troglitazone, pioglitazone hydrochloride, rosiglitazone maleate, sodium darglitazone, GI-262570, isaglitazone, LG-100641, NC-2100, T-174, DRF-2189, CLX-0921, CS-011, GW-1929, ciglitazone, sodium englitazone and NIP-221, peroxisome proliferator-activated receptor-α agonists such as GW-9578 and BM-170744, peroxisome proliferator-activated

receptor-α/γ agonists such as GW-409544, KRP-297, NN-622, CLX-0940, LR-90, SB-219994, DRF-4158 and DRF-MDX8, retinoid X receptor agonists such as ALRT-268, AGN-4204, MX-6054, AGN-194204, LG-100754 and bexarotene, and other insulin sensitivity enhancers such as reglixane, ONO-5816, MBX-102, CRE-1625, FK-614, CLX-0901, CRE-1633, NN-2344, BM-13125, BM-501050, HQL-975, CLX-0900, MBX-668, MBX-675, S-15261, GW-544, AZ-242, LY-510929, AR-H049020 and GW-501516 are illustrated. Insulin sensitivity enhancers are used preferably for diabetes, impaired glucose tolerance, diabetic complications, obesity, hyperinsulinemia, hyperlipidemia, hypercholesterolemia, hypertriglyceridemia, lipid metabolism disorder or atherosclerosis, and more preferably for diabetes, impaired glucose tolerance or hyperinsulinemia bacause of improving the disturbance of insulin signal transduction in peripheral tissues and enhancing glucose uptake into the tissues from the blood, leading to lowering of blood glucose level.

As glucose absorption inhibitors, compounds other othan SGLT1 inhibitors, for example, α-glucosidase inhibitors such as acarbose, voglibose, miglitol, CKD-711, emiglitate, MDL-25,637, camiglibose and MDL-73,945, and α-amylase inhibitors such as AZM-127 are illustrated. Glucose absorption inhibitors are used preferably for diabetes, impaired glucose tolerance, diabetic complications, obesity or hyperinsulinemia, and more preferably for impaired glucose tolerance because of inhibiting the gastrointestinal enzymatic digestion of carbohydrates contained in foods, and inhibiting

or delaying the absorption of glucose into the body.

As biguanides, phenformin, buformin hydrochloride, metformin hydrochloride or the like are illustrated. Biguanides are used preferably for diabetes, impaired glucose tolerance, diabetic complications or hyperinsulinemia, and more preferably for diabetes, impaired glucose tolerance or hyperinsulinemia because of lowering blood glucose level by inhibitory effects on hepatic gluconeogenesis, accelerating effects on anaerobic glycolysis in tissues or improving effects on insulin resistance in peripheral tissues.

As insulin secretion enhancers, tolbutamide, chlorpropamide, tolazamide, acetohexamide, glyclopyramide, glyburide (glibenclamide), gliclazide, 1-butyl-3-metanilyl-urea, carbutamide, glibornuride, glipizide, gliquidone, glisoxapide, glybuthiazol, glybuzole, glyhexamide, sodium glymidine, glypinamide, phenbutamide, tolcyclamide, glimepiride, nateglinide, mitiglinide calcium hydrate, repaglinide or the like are illustrated. In addition, the insulin secretion enhancers include glucokinase activators such as RO-28-1675. Insulin secretion enhancers are used preferably for diabetes, impaired glucose tolerance or diabetic complications, and more preferably for diabetes or impaired glucose tolerance because of lowering blood glucose level by acting on pancreatic β-cells and enhancing the insulin secretion.

As SGLT2 inhibitors, T-1095 and compounds described in Japanese patent publications Nos. Hei10-237089 and 2001-288178, and International Publications Nos. WO01/16147, WO01/27128,

WO01/68660, WO01/74834, WO01/74835, WO02/28872, WO02/36602, WO02/44192, WO02/53573 etc. are illustrated. SGLT2 inhibitors are used preferably for diabetes, impaired glucose tolerance, diabetic complications, obesity or hyperinsulinemia, and more preferably for diabetes, impaired glucose tolerance, obesity or hyperinsulinemia because of lowering blood glucose level by inhibiting the reabsorption of glucose at the kidney's proximal tubule.

As insulin or insulin analogues, human insulin, animal-derived insulin, human or animal-derived insulin analogues or the like are illustrated. These preparations are used preferably for diabetes, impaired glucose tolerance or diabetic complications, and more preferably for diabetes or impaired glucose tolerance.

As glucagon receptor antagonists, BAY-27-9955, NNC-92-1687 or the like are illustrated; as insulin receptor kinase stimulants, TER-17411, L-783281, KRX-613 or the like are illustrated; as tripeptidyl peptidase II inhibitors, UCL-1397 or the like are illustrated; as dipeptidyl peptidase IV inhibitors, NVP-DPP728A, TSL-225, P-32/98 or the like are illustrated; as protein tyrosine phosphatase 1B inhibitors, PTP-112, OC-86839, PNU-177496 or the like are illustrated; as glycogen phosphorylase inhibitors, NN-4201, CP-368296 or the like are illustrated; as fructose-bisphosphatase inhibitors, R-132917 or the like are illustrated; as pyruvate dehydrogenase inhibitors, AZD-7545 or the like are illustrated; as hepatic gluconeogenesis inhibitors, FR-225659 or the like are

illustrated; as glucagon-like peptide-1 analogues, exendin-4, CJC-1131 or the like are illustrated; as glucagon-like peptide 1 agonists; AZM-134, LY-315902 or the like are illustrated; and as amylin, amylin analogues or amylin agonists, pramlintide acetate or the like are illustrated. These drugs, glucose-6-phosphatase inhibitors, D-chiroinsitol, glycogen synthase kinase-3 inhibitors and glucagon-like peptide-1 are used preferably for diabetes, impaired glucose tolerance, diabetic complications or hyperinsulinemia, and more preferably for diabetes or impaired glucose tolerance.

As aldose reductase inhibitors, ascorbyl gamolenate, tolrestat, epalrestat, ADN-138, BAL-ARI8, ZD-5522, ADN-311, GP-1447, IDD-598, fidarestat, sorbinil, ponalrestat, risarestat, zenarestat, minalrestat, methosorbinil, AL-1567, imirestat, M-16209, TAT, AD-5467, zopolrestat, AS-3201, NZ-314, SG-210, JTT-811, lindolrestat or the like are illustrated. Aldose reductase inhibitors are preferably used for diabetic complications because of inhibiting aldose reductase and lowering excessive intracellular accumulation of sorbitol in accelated polyol pathway which are in continuous hyperglycemic condition in the tissues in diabetic complications.

As advanced glycation endproducts formation inhibitors, pyridoxamine, OPB-9195, ALT-946, ALT-711, pimagedine hydrochloride or the like are illustrated. Advanced glycation endproducts formation inhibitors are preferably used for diabetic complications because of inhibiting formation of advanced glycation endproducts which are accelated in continuous

hyperglycemic condition in diabetes and declining of cellular damage.

As protein kinase C inhibitors, LY-333531, midostaurin or the like are illustrated. Protein kinase C inhibitors are preferably used for diabetic complications because of inhibiting of protein kinase C activity which is accelated in continuous hyperglycemic condition in diabetes.

As γ-aminobutyric acid receptor antagonists, topiramate or the like are illustrated; as sodium channel antagonists, mexiletine hydrochloride, oxcarbazepine or the like are illustrated; as transcrit factor NF-κB inhibitors, dexlipotam or the like are illustrated; as lipid peroxidase inhibitors, tirilazad mesylate or the like are illustrated; as *N*-acetylated-α-linked-acid-dipeptidase inhibitors, GPI-5693 or the like are illustrated; and as carnitine derivatives, carnitine, levacecarnine hydrochloride, levocarnitine chloride, levocarnitine, ST-261 or the like are illustrated. These drugs, insulin-like growth factor-I, platelet-derived growth factor, platelet derived growth factor analogues, epidermal growth factor, nerve growth factor, uridine, 5-hydroxy-1-methyl-hidantoin, EGB-761, bimoclomol, sulodexide and Y-128 are preferably used for diabetic complications.

As antidiarrhoics or cathartics, polycarbophil calcium, albumin tannate, bismuth subnitrate or the like are illustrated. These drugs are preferably used for diarrhea, constipation or the like accompanying diabetes or the like.

As hydroxymethylglutaryl coenzyme A reductase inhibitors,

sodium cerivastatin, sodium pravastatin, lovastatin, simvastatin, sodium fluvastatin, atorvastatin calcium hydrate, SC-45355, SQ-33600, CP-83101, BB-476, L-669262, S-2468, DMP-565, U-20685, BAY-x-2678, BAY-10-2987, calcium pitavastatin, calcium rosuvastatin, colestolone, dalvastatin, acitemate, mevastatin, crilvastatin, BMS-180431, BMY-21950, glenvastatin, carvastatin, BMY-22089, bervastatin or the like are illustrated. Hydroxymethylglutaryl coenzyme A reductase inhibitors are used preferably for hyperlipidemia, hypercholesterolemia, hypertriglyceridemia, lipid metabolism disorder or atherosclerosis, and more preferably for hyperlipidemia, hypercholesterolemia or atherosclerosis because of lowering blood cholesterol level by inhibiting hydroxymethylglutaryl coenzyme A reductase.

As fibric acid derivatives, bezafibrate, beclobrate, binifibrate, ciprofibrate, clinofibrate, clofibrate, aluminum clofibrate, clofibric acid, etofibrate, fenofibrate, gemfibrozil, nicofibrate, pirifibrate, ronifibrate, simfibrate, theofibrate, AHL-157 or the like are illustrated. Fibric acid derivatives are used preferably for hyperinsulinemia, hyperlipidemia, hypercholesterolemia, hypertriglyceridemia, lipid metabolism disorder or atherosclerosis, and more preferably for hyperlipidemia, hypertriglyceridemia or atherosclerosis because of activating hepatic lipoprotein lipase and enhancing fatty acid oxidation, leading to lowering of blood triglyceride level.

As β_3-adrenoceptor agonists, BRL-28410, SR-58611A,

ICI-198157, ZD-2079, BMS-194449, BRL-37344, CP-331679, CP-114271, L-750355, BMS-187413, SR-59062A, BMS-210285, LY-377604, SWR-0342SA, AZ-40140, SB-226552, D-7114, BRL-35135, FR-149175, BRL-26830A, CL-316243, AJ-9677, GW-427353, N-5984, GW-2696, YM178 or the like are illustrated. β_3-Adrenoceptor agonists are used preferably for obesity, hyperinsulinemia, hyperlipidemia, hypercholesterolemia, hypertriglyceridemia or lipid metabolism disorder, and more preferably for obesity or hyperinsulinemia because of stimulating β_3-adrenoceptor in adipose tissue and enhancing the fatty acid oxidation, leading to induction of energy expenditure.

As acyl-coenzyme A cholesterol acyltransferase inhibitors, NTE-122, MCC-147, PD-132301-2, DUP-129, U-73482, U-76807, RP-70676, P-06139, CP-113818, RP-73163, FR-129169, FY-038, EAB-309, KY-455, LS-3115, FR-145237, T-2591, J-104127, R-755, FCE-28654, YIC-C8-434, avasimibe, CI-976, RP-64477, F-1394, eldacimibe, CS-505, CL-283546, YM-17E, lecimibide, 447C88, YM-750, E-5324, KW-3033, HL-004, eflucimibe or the like are illustrated. Acyl-coenzyme A cholesterol acyltransferase inhibitors are used preferably for hyperlipidemia, hypercholesterolemia, hypertriglyceridemia or lipid metabolism disorder, and more preferably for hyperlipidemia or hypercholesterolemia because of lowering blood cholesterol level by inhibiting acyl-coenzyme A cholesterol acyltransferase.

As thyroid hormone recptor agonists, sodium liothyronine, sodium levothyroxine, KB-2611 or the like are illustrated; as cholesterol absorption inhibitors, ezetimibe, SCH-48461 or the

like are illustrated; as lipase inhibitors, orlistat, ATL-962, AZM-131, RED-103004 or the like are illustrated; as carnitine palmitoyltransferase inhibitors, etomoxir or the like are illustrated; as squalene synthase inhibitors, SDZ-268-198, BMS-188494, A-87049, RPR-101821, ZD-9720, RPR-107393, ER-27856 or the like are illustrated; as nicotinic acid derivatives, nicotinic acid, nicotinamide, nicomol, niceritrol, acipimox, nicorandil or the like are illustrated; as bile acid sequestrants, colestyramine, colestilan, colesevelam hydrochloride, GT-102-279 or the like are illustrated; as sodium/bile acid cotransporter inhibitors, 264W94, S-8921, SD-5613 or the like are illustrated; and as cholesterol ester transfer protein inhibitors, PNU-107368E, SC-795, JTT-705, CP-529414 or the like are illustrated. These drugs, probcol, microsomal trigylceride transfer protein inhibitors, lipoxygenase inhibitors and low-density lipoprotein receptor enhancers are preferably used for hyperlipidemia, hypercholesterolemia, hypertriglyceridemia or lipid metabolism disorder.

As appetite suppressants, monoamine reuptake inhibitors, serotonin reuptake inhibitors, serotonin releasing stimulants, serotonin agonists (especially $5HT_{2C}$-agonists), noradrenaline reuptake inhibitors, noradrenaline releasing stimulants, α_1-adrenoceptor agonists, β_2-adrenoceptor agonists, dopamine agonists, cannabinoid receptor antagonists, γ-aminobutyric acid receptor antagonists, H_3-histamine antagonists, L-histidine, leptin, leptin analogues, leptin receptor agonists, melanocortin receptor agonists (especially, MC3-R agonists,

MC4-R agonists), α-melanocyte stimulating hormone, cocaine-and amphetamine-regulated transcript, mahogany protein, enterostatin agonists, calcitonin, calcitonin-gene-related peptide, bombesin, cholecystokinin agonists (especially CCK-A agonists), corticotropin-releasing hormone, corticotrophin-releasing hormone analogues, corticotropin-releasing hormone agonists, urocortin, somatostatin, somatostatin analogues, somatostatin receptor agonists, pituitary adenylate cyclase-activating peptide, brain-derived neurotrophic factor, ciliary neurotrophic factor, thyrotropin-releasing hormone, neurotensin, sauvagine, neuropeptide Y antagonists, opioid peptide antagonists, galanin antagonists, melanin-concentrating hormone antagonists, agouti-related protein inhibitors and orexin receptor antagonists are illustrated. Concretely, as monoamine reuptake inhibitors, mazindol or the like are illustrated; as serotonin reuptake inhibitors, dexfenfluramine hydrochloride, fenfluramine, sibutramine hydrochloride, fluvoxamine maleate, sertraline hydrochloride or the like are illustrated; as serotonin agonists, inotriptan, (+)-norfenfluramine or the like are illustrated; as noradrenaline reuptake inhibitors, bupropion, GW-320659 or the like are illustrated; as noradrenaline releasing stimulants, rolipram, YM-992 or the like are illustrated; as β_2-adrenoceptor agonists, amphetamine, dextroamphetamine, phentermine, benzphetamine, methamphetamine, phendimetrazine, phenmetrazine, diethylpropion, phenylpropanolamine, clobenzorex or the like are illustrated; as dopamine agonists,

ER-230, doprexin, bromocriptine mesylate or the like are illustrated; as cannabinoid receptor antagonists, rimonabant or the like are illustrated; as γ-aminobutyric acid receptor antagonists, topiramate or the like are illustrated; as H_3-histamine antagonists, GT-2394 or the like are illustrated; as leptin, leptin analogues or leptin receptor agonists, LY-355101 or the like are illustrated; as cholecystokinin agonists (especially CCK-A agonists), SR-146131, SSR-125180, BP-3.200, A-71623, FPL-15849, GI-248573, GW-7178, GI-181771, GW-7854, A-71378 or the like are illustrated; and as neuropeptide Y antagonists, SR-120819-A, PD-160170, NGD-95-1, BIBP-3226, 1229-U-91, CGP-71683, BIBO-3304, CP-671906-01, J-115814 or the like are illustrated. Appetite suppressants are used preferably for diabetes, impaired glucose tolerance, diabetic complications, obesity, hyperlipidemia, hypercholesterolemia, hypertriglyceridemia, lipid metabolism disorder, atherosclerosis, hypertension, congestive heart failure, edema, hyperuricemia or gout, and more preferably for obesity because of stimulating or inhibiting the activities of intracerebral monoamines or bioactive peptides in central appetite regulatory system and suppressing the appetite, leading to reduction of energy intake.

As angiotensin-converting enzyme inhibitors, captopril, enalapri maleate, alacepril, delapril hydrochloride, ramipril, lisinopril, imidapril hydrochloride, benazepril hydrochloride, ceronapril monohydrate, cilazapril, sodium fosinopril, perindopril erbumine, calcium moveltipril, quinapril hydro-

chloride, spirapril hydrochloride, temocapril hydrochloride, trandolapril, calcium zofenopril, moexipril hydrochloride, rentiapril or the like are illustrated. Angiotensin-converting enzyme inhibitors are preferably used for diabetic complications or hypertension.

As neutral endopeptidase inhibitors, omapatrilat, MDL-100240, fasidotril, sampatrilat, GW-660511X, mixanpril, SA-7060, E-4030, SLV-306, ecadotril or the like are illustrated. Neutral endopeptidase inhibitors are preferably used for diabetic complications or hypertension.

As angiotensin II receptor antagonists, candesartan cilexetil, candesartan cilexetil/hydrochlorothiazide, potassium losartan, eprosartan mesylate, valsartan, telmisartan, irbesartan, EXP-3174, L-158809, EXP-3312, olmesartan, tasosartan, KT-3-671, GA-0113, RU-64276, EMD-90423, BR-9701 or the like are illustrated. Angiotensin II receptor antagonists are preferably used for diabetic complications or hypertension.

As endothelin-converting enzyme inhibitors, CGS-31447, CGS-35066, SM-19712 or the like are illustrated; as endothelin receptor antagonists, L-749805, TBC-3214, BMS-182874, BQ-610, TA-0201, SB-215355, PD-180988, sodium sitaxsentan, BMS-193884, darusentan, TBC-3711, bosentan, sodium tezosentan, J-104132, YM-598, S-0139, SB-234551, RPR-118031A, ATZ-1993, RO-61-1790, ABT-546, enlasentan, BMS-207940 or the like are illustrated. These drugs are preferably used for diabetic complications or hypertension, and more preferably for hypertension.

As diuretic agents, chlorthalidone, metolazone, cyclopenthiazide, trichloromethiazide, hydrochlorothiazide, hydroflumethiazide, benzylhydrochlorothiazide, penflutizide, methyclothiazide, indapamide, tripamide, mefruside, azosemide, etacrynic acid, torasemide, piretanide, furosemide, bumetanide, meticrane, potassium canrenoate, spironolactone, triamterene, aminophylline, cicletanine hydrochloride, LLU-α, PNU-80873A, isosorbide, D-mannitol, D-sorbitol, fructose, glycerin, acetazolamide, methazolamide, FR-179544, OPC-31260, lixivaptan, conivaptan hydrochloride or the like are illustrated. Diuretic drugs are preferably used for diabetic complications, hypertension, congestive heart failure or edema, and more preferably for hypertension, congestive heart failure or edema because of reducing blood pressure or improving edema by increasing urinary excretion.

As calcium antagonists, aranidipine, efonidipine hydrochloride, nicardipine hydrochloride, barnidipine hydrochloride, benidipine hydrochloride, manidipine hydrochloride, cilnidipine, nisoldipine, nitrendipine, nifedipine, nilvadipine, felodipine, amlodipine besilate, pranidipine, lercanidipine hydrochloride, isradipine, elgodipine, azelnidipine, lacidipine, vatanidipine hydrochloride, lemildipine, diltiazem hydrochloride, clentiazem maleate, verapamil hydrochloride, S-verapamil, fasudil hydrochloride, bepridil hydrochloride, gallopamil hydrochloride or the like are illustrated; as vasodilating antihypertensive agents, indapamide, todralazine hydrochloride,

hydralazine hydrochloride, cadralazine, budralazine or the like are illustrated; as sympathetic blocking agents, amosulalol hydrochloride, terazosin hydrochloride, bunazosin hydrochloride, prazosin hydrochloride, doxazosin mesylate, propranolol hydrochloride, atenolol, metoprolol tartrate, carvedilol, nipradilol, celiprolol hydrochloride, nebivolol, betaxolol hydrochloride, pindolol, tertatolol hydrochloride, bevantolol hydrochloride, timolol maleate, carteolol hydrochloride, bisoprolol hemifumarate, bopindolol malonate, nipradilol, penbutolol sulfate, acebutolol hydrochloride, tilisolol hydrochloride, nadolol, urapidil, indoramin or the like are illustrated; as centrally acting antihypertensive agents, reserpine or the like are illustrated; and as α_2-adrenoceptor agonists, clonidine hydrochloride, methyldopa, CHF-1035, guanabenz acetate, guanfacine hydrochloride, moxonidine, lofexidine, talipexole hydrochloride or the like are illustrated. These drugs are preferably used for hypertension.

As antiplatelets agents, ticlopidine hydrochloride, dipyridamole, cilostazol, ethyl icosapentate, sarpogrelate hydrochloride, dilazep dihydrochloride, trapidil, beraprost sodium, aspirin or the like are illustrated. Antiplatelets agents are preferably used for atherosclerosis or congestive heart failure.

As uric acid synthesis inhibitors, allopurinol, oxypurinol or the like are illustrated; as uricosuric agents, benzbromarone, probenecid or the like are illustrated; and as

urinary alkalinizers, sodium hydrogen carbonate, potassium citrate, sodium citrate or the like are illustrated. These drugs are preferably used for hyperuricemia or gout.

In case of uses in combination with drugs other than SGLT2 inhibitors, for example, in the use for diabetes, the combination with at least one member of the group consisting of an insulin sensitivity enhancer, a glucose absorption inhibitor, a biguanide, an insulin secretion enhancer, a SGLT2 inhibitors, an insulin or insulin analogue, a glucagon receptor antagonist, an insulin receptor kinase stimulant, a tripeptidyl peptidase II inhibitor, a dipeptidyl peptidase IV inhibitor, a protein tyrosine phosphatase-1B inhibitor, a glycogen phosphorylase inhibitor, a glucose-6-phosphatase inhibitor, a fructose-bisphosphatase inhibitor, a pyruvate dehydrogenase inhibitor, a hepatic gluconeogenesis inhibitor, D-chiroinsitol, a glycogen synthase kinase-3 inhibitor, glucagon-like peptide-1, a glucagon-like peptide-1 analogue, a glucagon-like peptide-1 agonist, amylin, an amylin analogue, an amylin agonist and an appetite suppressant is preferable; the combination with at least one member of the group consisting of an insulin sensitivity enhancer, a biguanide, an insulin secretion enhancer, a SGLT2 inhibitors, an insulin or insulin analogue, a glucagon receptor antagonist, an insulin receptor kinase stimulant, a tripeptidyl peptidase II inhibitor, a dipeptidyl peptidase IV inhibitor, a protein tyrosine phosphatase-1B inhibitor, a glycogen phosphorylase inhibitor, a glucose-6-phosphatase inhibitor, a fructose-bisphosphatase inhibitor, a pyruvate dehydrogenase

inhibitor, a hepatic gluconeogenesis inhibitor, D-chiroinsitol, a glycogen synthase kinase-3 inhibitor, glucagon-like peptide-1, a glucagon-like peptide-1 analogue, a glucagon-like peptide-1 agonist, amylin, an amylin analogue and an amylin agonist is more preferable; and the combination with at least one member of the group consisting of an insulin sensitivity enhancer, a biguanide, an insulin secretion enhancer, a SGLT2 inhibitor and an insulin or insulin analogue is most preferable. Similarly, in the use for diabetic complications, the combination with at least one member of the group consisting of an insulin sensitivity enhancer, a glucose absorption inhibitor, a biguanide, an insulin secretion enhancer, a SGLT2 inhibitor, an insulin or insulin analogue, a glucagon receptor antagonist, an insulin receptor kinase stimulant, a tripeptidyl peptidase II inhibitor, a dipeptidyl peptidase IV inhibitor, a protein tyrosine phosphatase-1B inhibitor, a glycogen phosphorylase inhibitor, a glucose-6-phosphatase inhibitor, a fructose-bisphosphatase inhibitor, a pyruvate dehydrogenase inhibitor, a hepatic gluconeogenesis inhibitor, D-chiroinsitol, glycogen synthase kinase-3 inhibitors, glucagon-like peptide-1, a glucagon-like peptide-1 analogue, a glucagon-like peptide-1 agonist, amylin, an amylin analogue, an amylin agonist, an aldose reductase inhibitor, an advanced glycation endproducts formation inhibitor, a protein kinase C inhibitor, a γ-aminobutyric acid antagonist, a sodium channel antagonist, a transcript factor NF-κB inhibitor, a lipid peroxidase inhibitor, an *N*-acetylated-α-linked-acid-dipeptidase inhibitor, insulin-like growth

factor-I, platelet-derived growth factor, a platelet derived growth factor analogue, epidermal growth factor, nerve growth factor, a carnitine derivative, uridine, 5-hydroxy-1-methylhidantoin, EGB-761, bimoclomol, sulodexide, Y-128, an angiotensin-converting enzyme inhibitor, a neutral endopeptidase inhibitor, an angiotensin II receptor antagonist, an endothelin-converting enzyme inhibitor, an endothelin receptor antagonist and a diuretic agnet is preferable; and the combination with at least one member of the group consisting of an aldose reductase inhibitor, an angiotensin-converting enzyme inhibitor, a neutral endopeptidase inhibitor and an angiotensin II receptor antagonist is more preferable. Furthermore, in the use for obesity, the combination with at least one member of the group consisting of an insulin sensitivity enhancer, a glucose absorption inhibitor, a biguanide, an insulin secretion enhancer, a SGLT2 inhibitor, an insulin or insulin analogue, a glucagon receptor antagonist, an insulin receptor kinase stimulant, a tripeptidyl peptidase II inhibitor, a dipeptidyl peptidase IV inhibitor, a protein tyrosine phosphatase-1B inhibitor, a glycogen phosphorylase inhibitor, a glucose-6-phosphatase inhibitor, a fructose-bisphosphatase inhibitor, a pyruvate dehydrogenase inhibitor, a hepatic gluconeogenesis inhibitor, D-chiroinsitol, a glycogen synthase kinase-3 inhibitor, glucagon-like peptide-1, a glucagon-like peptide-1 analogue, a glucagon-like peptide-1 agonist, amylin, an amylin analogue, an amylin agonist, a β_3-adrenoceptor agonist and an appetite suppressant is preferable; and the combination

with at least one member of the group consisting of a SGLT2 inhibitor, a β_3-adrenoceptor agonist and an appetite suppressant is more preferable.

When the pharmaceutical compositions of the present invention are employed in the practical treatment, various dosage forms are used depending on their uses. As examples of the dosage forms, powders, granules, fine granules, dry sirups, tablets, capsules, injections, solutions, ointments, suppositories, poultices and the like are illustrated, which are orally or parenterally administered. The pharmaceutical compositions of the present invention also include sustained release formulation including gastrointestinal mucoadhesive formulation (e.g., International publications Nos. WO99/10010, WO99/26606, and Japanese patent publication No. 2001-2567).

These pharmaceutical compositions can be prepared by admixing with or by diluting and dissolving with an appropriate pharmaceutical additive such as excipients, disintegrators, binders, lubricants, diluents, buffers, isotonicities, antiseptics, moistening agents, emulsifiers, dispersing agents, stabilizing agents, dissolving aids and the like, and formulating the mixture in accordance with conventional methods. In case of the uses of the compound of the present invention in combination with the drug(s) other than SGLT1 inhibitors, they can be prepared by formulating each active ingredient together or individually.

When the pharmaceutical compositions of the present invention are employed in the practical treatment, the dosage of a compound represented by the above general formula (I), a

pharmaceutically acceptable salt thereof or a prodrug thereof as the active ingredient is appropriately decided depending on the age, sex, body weight and degree of symptoms and treatment of each patient, which is approximately within the range of from 0.1 to 1,000mg per day per adult human in the case of oral administration and approximately within the range of from 0.01 to 300mg per day per adult human in the case of parenteral administration, and the daily dose can be divided into one to several doses per day and administered suitably. Also, in case of the uses of the compound of the present invention in combination with the drug(s) other than SGLT1 inhibitors, the dosage of the compound of the present invention can be decreased, depending on the dosage of the drug(s) other than SGLT1 inhibitors.

Examples

The present invention is further illustrated in more detail by way of the following Reference Examples, Examples and Test Examples. However, the present invention is not limited thereto.

Reference Example 1

2-Amino-2-methylpropionamide

To a solution of 2-benzyloxycarbonylamino-2-methyl-propionic acid (1 g) in *N*,*N*-dimethylformamide (10 mL) were added 1-hydroxybenzotriazole(0.63 g), 1-ethyl-3-(3-dimethylamino-propyl)carbodiimide hydrochloride (1.21 g), triethylamine (1.76 mL) and 28% aqueous ammonia solution (2 mL), and the mixture

was stirred at room temperature overnight. The reaction mixture was poured into water, and the resulting mixture was extracted with ethyl acetate. The organic layer was washed with 0.5 mol/L hydrochloric acid, water, 1 mol/L aqueous sodium hydroxide solution, water and brine successively, and dried over anhydrous sodium sulfate. The solvent was removed under reduced pressure to give 2-benzyloxycarbonylamino-2-methylpropionamide (0.26 g). This material was dissolved in methanol (5 mL). To the solution was added 10%palladium-carbon powder (30 mg), and the mixture was stirred under a hydrogen atmosphere for 3 hours. The insoluble material was removed by filtration, and the filtrate was concentrated under reduced pressure to give the title compound (0.11 g).

^{1}H−NMR (DMSO-d_6) δ ppm:

1.15 (6H, s), 1.9 (2H, brs), 6.83 (1H, brs), 7.26 (1H, brs)

Reference Example 2

4-[(4-Bromophenyl)methyl]-1,2-dihydro-5-isopropyl-3*H*-pyrazol-3-one

To a suspension of sodium hydride (60%, 3.85 g) in tetrahydrofuran (250 mL) was added ethyl 4-methyl-3-oxo-pentanoate (15.2 g), and the mixture was stirred at 0°C for 10 minutes. To the reaction mixture was added a solution of 4-bromobenzyl bromide (20 g) in tetrahydrofuran (100 mL), and the mixture was stirred at room temperature overnight. To the reaction mixture was added water, and the resulting mixture was extracted with ethyl acetate. The organic layer was dried over

anhydrous sodium sulfate, and the solvent was removed under reduced pressure. To a solution of the residue in toluene (10 mL) was added hydrazine monohydrate (8.01 g), and the mixture was stirred at 100°C overnight. After cooling the reaction mixture to room temperature, the solvent was removed under reduced pressure. To the residue was added ethyl acetate (20 mL), and the mixture was stirred at room temperature for 2 hours. The precipitated crystals were collected by filtration. The collected crystals were washed with water and *n*-hexane successively, and dried at 40°C under reduced pressure to give the title compound (11.5 g).

^{1}H—NMR (DMSO-d_6) δ ppm:

1.07 (6H, d, J=7.1Hz), 2.75-2.9 (1H, m), 3.55 (2H, s), 7.05-7.15 (2H, m), 7.35-7.45 (2H, m)

Reference Example 3

3-(2,3,4,6-Tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-bromophenyl)methyl]-5-isopropyl-1*H*-pyrazole

To a suspension of 4-[(4-bromophenyl)methyl]-1,2-dihydro-5-isopropyl-3*H*-pyrazol-3-one (5.0 g) in dichloromethane (50 mL) were added acetobromo-α-D-glucose (7.0 g), benzyltri(*n*-butyl)ammonium chloride (5.3 g) and 5 mol/L aqueous sodium hydroxide solution (8.5 mL), and the mixture was stirred at room temperature overnight. The organic layer was separated, and the solvent was removed under reduced pressure. The residue was purified by column chromatography on silica gel (eluent: *n*-hexane/ethyl acetate = 1/1) to give the title compound (4.12

g).

^{1}H−NMR ($CDCl_3$) δ ppm:

1.1-1.25 (6H, m), 1.86 (3H, s), 2.01 (3H, s), 2.03 (3H, s), 2.06 (3H, s), 2.85-2.95 (1H, m), 3.58 (1H, d, J=16.2Hz), 3.64 (1H, d, J=16.2Hz), 3.8-3.95 (1H, m), 4.15 (1H, dd, J=12.4Hz, 2.2Hz), 4.32 (1H, dd, J=12.4Hz, 3.9Hz), 5.15-5.35 (3H, m), 5.53 (1H, d, J=7.5Hz), 6.95-7.05 (2H, m), 7.3-7.4 (2H, m)

Reference Example 4

3-(2,3,4,6-Tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-({4-[(1*E*)-3-carboxyprop-1-enyl]phenyl}methyl)-5-isopropyl-1*H*-pyrazole

To a solution of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-bromophenyl)methyl]-5-isopropyl-1*H*-pyrazole (3.0 g) and 3-butenoic acid (1.0 g) in acetonitrile (15 mL) were added triethylamine (2.4 g), palladium acetate (II) (0.11 g) and tris(2-methylphenyl)phosphine (0.29 g), and the mixture was refluxed overnight under shading the light. The solvent was removed under reduced pressure, and the residue was purified by column chromatography on silica gel (eluent: ethyl acetate - dichloromethane/methanol = 10/1) to give the title compound (1.74 g).

^{1}H−NMR ($CDCl_3$) δ ppm:

1.1-1.2 (6H, m), 1.84 (3H, s), 2.01 (3H, s), 2.02 (3H, s), 2.05 (3H, s), 2.8-2.95 (1H, m), 3.2-3.3 (2H, m), 3.59 (1H, d, J=16.0Hz), 3.66 (1H, d, J=16.0Hz), 3.8-3.9 (1H, m), 4.18 (1H, dd, J=12.3Hz, 1.8Hz), 4.33 (1H, dd, J=12.3Hz, 3.8Hz), 5.15-5.35 (3H, m),

5.4-5.5 (1H, m), 6.2-6.3 (1H, m), 6.4-6.5 (1H, m), 7.0-7.1 (2H, m), 7.2-7.3 (2H, m)

Reference Example 5

3-(2,3,4,6-Tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-({4-[(1*E*)-2-carboxyvinyl]phenyl}methyl)-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Reference Example 4 using acrylic acid instead of 3-butenoic acid.

^{1}H−NMR ($CDCl_3$) δ ppm:

1.19 (6H, d, J=7.3Hz), 1.84 (3H, s), 2.01 (3H, s), 2.04 (3H, s), 2.05 (3H, s), 2.85-3.0 (1H, m), 3.66 (1H, d, J=16.2Hz), 3.73 (1H, d, J=16.2Hz), 3.85-3.95 (1H, m), 4.2 (1H, dd, J=12.6Hz, 2.2Hz), 4.34 (1H, dd, J=12.6Hz, 4.1Hz), 5.15-5.35 (3H, m), 5.5 (1H, d, J=7.7Hz), 6.4 (1H, d, J=15.7Hz), 7.15-7.2 (2H, m), 7.4-7.5 (2H, m), 7.71 (1H, d, J=15.7Hz)

Example 1

4-({4-[3-(Carbamoylmethylcarbamoyl)propyl]phenyl}methyl)-3-(β-D-glucopyranosyloxy)-5-isopropyl-1*H*-pyrazole

To a solution of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-({4-[(1*E*)-3-carboxyprop-1-enyl]phenyl}methyl)-5-isopropyl-1*H*-pyrazole (0.34 g) in *N*,*N*-dimethylformamide (1 mL) were added glycinamide hydrochloride (0.12 g), 1-hydroxybenzotriazole(0.09 g), 1-ethyl-3-(3-dimethylaminopropyl)carbodiimide hydrochloride (0.15 g) and triethylamine (0.27 g), and the mixture was stirred at room temperature

overnight. The insoluble material was removed by filtration. To the filtrate was added 5 mol/L aqueous sodium hydroxide solution (0.5 mL), and the mixture was stirred at room temperature for 1 hour. The insoluble material was removed by filtration, and the filtrate was purified by preparative reverse phase column chromatography (Shiseido CAPCELL PAK UG120 ODS, 5 μm, 120 Å, 20 x 50 mm, flow rate 30 mL/minute linear gradient, water/acetonitrile = 90/10 - 10/90) to give 4-({4-[(1*E*)-3-(carbamoylmethylcarbamoyl)prop-1-enyl]phenyl}methyl)-3-(β-D-glucopyranosyloxy)-5-isopropyl-1*H*-pyrazole (0.03 g). This material was dissolved in methanol (1 mL). To the solution was added 10% palladium-carbon powder (0.01 g), and the mixture was stirred at room temperature under a hydrogen atmosphere for 3 hours. The insoluble material was removed by filtration, and the solvent of the filtrate was removed under reduced pressure to give the title compound (0.02 g).

^{1}H−NMR (CD_3OD) δ ppm:

1.1-1.2 (6H, m), 1.85-1.95 (2H, m), 2.25 (2H, t, J=7.6Hz), 2.6 (2H, t, J=7.5Hz), 2.85-2.95 (1H, m), 3.25-3.4 (4H, m), 3.6-3.9 (6H, m), 5.0-5.1 (1H, m), 7.0-7.15 (4H, m)

Example 2

4-{[4-(3-Carbamoylpropyl)phenyl]methyl}-3-(β-D-glucopyranosyloxy)-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 1 using ammonium chloride instead of glycinamide hydrochloride.

^{1}H—NMR (CD_3OD) δ ppm:

1.05-1.2 (6H, m), 1.8-1.95 (2H, m), 2.19 (2H, t, J=7.6Hz), 2.58 (2H, t, J=7.5Hz), 2.85-2.95 (1H, m), 3.3-3.45 (4H, m), 3.6-3.8 (3H, m), 3.8-3.9 (1H, m), 5.0-5.1 (1H, m), 7.0-7.15 (4H, m)

Example 3

4-({4-[3-(2-Carbamoylethylcarbamoyl)propyl]phenyl}methyl)-3-(β-D-glucopyranosyloxy)-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 1 using 3-aminopropionamide instead of glycinamide hydrochloride.

^{1}H—NMR (CD_3OD) δ ppm:

1.05-1.2 (6H, m), 1.8-1.95 (2H, m), 2.15 (2H, t, J=7.3Hz), 2.4 (2H, t, J=6.7Hz), 2.56 (2H, t, J=7.5Hz), 2.85-2.95 (1H, m), 3.25-3.45 (6H, m), 3.6-3.9 (4H, m), 5.0-5.1 (1H, m), 7.0-7.15 (4H, m)

Example 4

4-({4-[3-(2-Aminoethylcarbamoyl)propyl]phenyl}methyl)-3-(β-D-glucopyranosyloxy)-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 1 using *N*-benzyloxycarbonyl-1,2-diaminoethane hydrochloride instead of glycinamide hydrochloride.

^{1}H—NMR (CD_3OD) δ ppm:

1.1-1.2 (6H, m), 1.85-1.95 (2H, m), 2.19 (2H, t, J=7.6Hz), 2.58 (2H, t, J=7.5Hz), 2.8 (2H, t, J=6.1Hz), 2.85-2.95 (1H, m), 3.2-3.4

(6H, m), 3.6-3.9 (4H, m), 5.0-5.1 (1H, m), 7.0-7.15 (4H, m)

Example 5

4-({4-[3-(3-Aminopropylcarbamoyl)propyl]phenyl}methyl)-3-(β-D-glucopyranosyloxy)-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 1 using *N*-benzyloxycarbonyl-1,3-diaminopropane hydrochloride instead of glycinamide hydrochloride.

^{1}H−NMR (CD_3OD) δ ppm:

1.1-1.2 (6H, m), 1.6-1.7 (2H, m), 1.8-1.95 (2H, m), 2.17 (2H, t, J=7.7Hz), 2.57 (2H, t, J=7.5Hz), 2.68 (2H, t, J=7.1Hz), 2.85-2.95 (1H, m), 3.22 (2H, t, J=6.7Hz), 3.25-3.45 (4H, m), 3.6-3.9 (4H, m), 5.0-5.1 (1H, m), 7.0-7.15 (4H, m)

Example 6

4-({4-[3-(4-Aminobutylcarbamoyl)propyl]phenyl}methyl)-3-(β-D-glucopyranosyloxy)-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 1 using *N*-benzyloxycarbonyl-1,4-diaminobutane hydrochloride instead of glycinamide hydrochloride.

^{1}H−NMR (CD_3OD) δ ppm:

1.1-1.2 (6H, m), 1.45-1.65 (4H, m), 1.8-1.95 (2H, m), 2.16 (2H, t, J=7.5Hz), 2.57 (2H, t, J=7.7Hz), 2.83 (2H, t, J=7.0Hz), 2.85-3.0 (1H, m), 3.17 (2H, t, J=6.6Hz), 3.25-3.45 (4H, m), 3.6-3.9 (4H, m), 5.0-5.1 (1H, m), 7.0-7.15 (4H, m)

Example 7

4-[(4-{3-[(*S*)-1-Carbamoyl-2-(4-hydroxyphenyl)ethyl-carbamoyl]propyl}phenyl)methyl]-3-(β-D-glucopyranosyloxy)-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 1 using L-tyrosine amide hydrochloride instead of glycinamide hydrochloride.

^{1}H−NMR (CD_3OD) δ ppm:

1.1-1.2 (6H, m), 1.7-1.8 (2H, m), 2.1-2.2 (2H, m), 2.44 (2H, t, J=7.5Hz), 2.76 (1H, dd, J=13.9Hz, 9.3Hz), 2.85-2.95 (1H, m), 3.04 (1H, dd, J=13.9Hz, 5.5Hz), 3.25-3.45 (4H, m), 3.6-3.9 (4H, m), 4.57 (1H, dd, J=9.3Hz, 5.5Hz), 5.0-5.1 (1H, m), 6.65-6.75 (2H, m), 6.95-7.15 (6H, m)

Example 8

4-{[4-(3-Benzylcarbamoylpropyl)phenyl]methyl}-3-(β-D-glucopyranosyloxy)-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 1 using benzylamine instead of glycinamide hydrochloride.

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.2 (6H, m), 1.85-1.95 (2H, m), 2.22 (2H, t, J=7.5Hz), 2.57 (2H, t, J=7.5Hz), 2.8-2.95 (1H, m), 3.25-3.45 (4H, m), 3.6-3.9 (4H, m), 4.33 (2H, s), 5.0-5.1 (1H, m), 7.0-7.15 (4H, m), 7.15-7.45 (5H, m)

Example 9

3-(β-D-Glucopyranosyloxy)-5-isopropyl-4-{[4-(3-phenethyl-carbamoylpropyl)phenyl]methyl}-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 1 using phenethylamine instead of glycinamide hydrochloride.

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.15 (6H, m), 1.75-1.9 (2H, m), 2.12 (2H, t, J=7.5Hz), 2.51 (2H, t, J=7.7Hz), 2.77 (2H, t, J=7.5Hz), 2.8-2.95 (1H, m), 3.25-3.45 (6H, m), 3.6-3.9 (4H, m), 5.0-5.15 (1H, m), 6.95-7.05 (2H, m), 7.05-7.3 (7H, m)

Example 10

3-(β-D-Glucopyranosyloxy)-5-isopropyl-4-({4-[3-(3-pyridyl-methylcarbamoyl)propyl]phenyl}methyl)-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 1 using 3-picolylamine instead of glycinamide hydrochloride.

^{1}H−NMR (CD_3OD) δ ppm:

1.1-1.15 (6H, m), 1.85-1.95 (2H, m), 2.22 (2H, t, J=7.6Hz), 2.56 (2H, t, J=7.6Hz), 2.85-2.95 (1H, m), 3.25-3.45 (4H, m), 3.6-3.9 (4H, m), 4.37 (2H, s), 5.0-5.1 (1H, m), 7.0-7.15 (4H, m), 7.35-7.45 (1H, m), 7.7-7.8 (1H, m), 8.4-8.45 (1H, m), 8.45-8.5 (1H, m)

Example 11

3-(β-D-Glucopyranosyloxy)-5-isopropyl-4-[(4-{3-[2-(2-pyridyl)ethylcarbamoyl]propyl}phenyl)methyl]-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 1 using 2-(2-aminoethyl)pyridine instead of glycinamide hydrochloride.

^{1}H−NMR (CD_3OD) δ ppm:

1.1-1.15 (6H, m), 1.75-1.9 (2H, m), 2.11 (2H, t, J=7.5Hz), 2.51 (2H, t, J=7.6Hz), 2.85-3.0 (3H, m), 3.25-3.45 (4H, m), 3.52 (2H, t, J=6.9Hz), 3.6-3.9 (4H, m), 5.0-5.1 (1H, m), 6.95-7.15 (4H, m), 7.2-7.35 (2H, m), 7.7-7.8 (1H, m), 8.4-8.5 (1H, m)

Example 12

3-(β-D-Glucopyranosyloxy)-5-isopropyl-4-[(4-{3-[2-(dimethylamino)ethylcarbamoyl]propyl}phenyl)methyl]-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 1 using *N*,*N*-dimethylethylenediamine instead of glycinamide hydrochloride.

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.2 (6H, m), 1.8-1.95 (2H, m), 2.17 (2H, t, J=7.6Hz), 2.25 (6H, s), 2.42 (2H, t, J=6.9Hz), 2.57 (2H, t, J=7.5Hz), 2.85-2.95 (1H, m), 3.25-3.4 (6H, m), 3.6-3.9 (4H, m), 5.0-5.1 (1H, m), 7.0-7.15 (4H, m)

Example 13

3-(β-D-Glucopyranosyloxy)-5-isopropyl-4-[(4-{3-[2-(morpholin-4-yl)ethylcarbamoyl]propyl}phenyl)methyl]-1*H*-pyrazole

The title compound was prepared in a similar manner to

that described in Example 1 using 4-(2-aminoethyl)morpholine instead of glycinamide hydrochloride.

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.2 (6H, m), 1.8-1.95 (2H, m), 2.17 (2H, t, J=7.6Hz), 2.4-2.55 (6H, m), 2.58 (2H, t, J=7.6Hz), 2.85-2.95 (1H, m), 3.25-3.45 (6H, m), 3.6-3.9 (8H, m), 5.0-5.1 (1H, m), 7.0-7.15 (4H, m)

Example 14

3-(β-D-Glucopyranosyloxy)-4-{[4-(3-{2-[bis(2-hydroxyethyl)-amino]ethylcarbamoyl}propyl)phenyl]methyl}-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 1 using *N*,*N*-bis(2-hydroxyethyl)-ethylenediamine instead of glycinamide hydrochloride.

^{1}H−NMR (CD_3OD) δ ppm:

1.1-1.15 (6H, m), 1.8-1.95 (2H, m), 2.18 (2H, t, J=7.5Hz), 2.5-2.7 (8H, m), 2.85-2.95 (1H, m), 3.25 (2H, t, J=6.4Hz), 3.3-3.4 (4H, m), 3.5-3.9 (8H, m), 5.0-5.1 (1H, m), 7.0-7.15 (4H, m)

Example 15

3-(β-D-Glucopyranosyloxy)-5-isopropyl-4-{[4-(3-{3-[bis(2-hydroxyethyl)amino]propylcarbamoyl}propyl)phenyl]methyl}-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 1 using *N*,*N*-bis(2-hydroxyethyl)-1,3-diaminopropane instead of glycinamide hydrochloride.

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.2 (6H, m), 1.6-1.75 (2H, m), 1.8-1.95 (2H, m), 2.17 (2H, t, J=7.5Hz), 2.5-2.75 (8H, m), 2.8-2.95 (1H, m), 3.21 (2H, t, J=6.7Hz), 3.25-3.45 (4H, m), 3.5-3.9 (8H, m), 5.0-5.15 (1H, m), 7.0-7.2 (4H, m)

Example 16

3-(β-D-Glucopyranosyloxy)-5-isopropyl-4-[(4-{3-[3-(dimethylamino)propylcarbamoyl]propyl}phenyl)methyl]-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 1 using *N*,*N*-dimethyl-1,3-diaminopropane instead of glycinamide hydrochloride.

^{1}H−NMR (CD_3OD) δ ppm:

1.1-1.15 (6H, m), 1.6-1.75 (2H, m), 1.8-1.95 (2H, m), 2.16 (2H, t, J=7.5Hz), 2.22 (6H, s), 2.3-2.35 (2H, m), 2.57 (2H, t, J=7.6Hz), 2.85-2.95 (1H, m), 3.17 (2H, t, J=6.9Hz), 3.25-3.45 (4H, m), 3.6-3.9 (4H, m), 5.0-5.1 (1H, m), 7.0-7.15 (4H, m)

Example 17

3-(β-D-Glucopyranosyloxy)-4-[(4-{3-[2-(imidazol-1-yl)ethylcarbamoyl]propyl}phenyl)methyl]-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 1 using 1-(2-aminoethyl)imidazole instead of glycinamide hydrochloride.

^{1}H−NMR (CD_3OD) δ ppm:

1.1-1.15 (6H, m), 1.8-2.0 (4H, m), 2.17 (2H, t, J=7.6Hz), 2.57

(2H, t, J=7.7Hz), 2.85-2.95 (1H, m), 3.14 (2H, t, J=6.8Hz), 3.3-3.45 (4H, m), 3.6-3.9 (4H, m), 4.03 (2H, t, J=7.0Hz), 5.0-5.1 (1H, m), 6.9-7.0 (1H, m), 7.0-7.15 (5H, m), 7.6-7.7 (1H, m)

Example 18

3-(β-D-Glucopyranosyloxy)-4-({4-[3-(2-hydroxyethyl)-carbamoylpropyl]phenyl}methyl)-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 1 using 2-aminoethanol instead of glycinamide hydrochloride.

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.15 (6H, m), 1.8-1.95 (2H, m), 2.18 (2H, t, J=7.5Hz), 2.57 (2H, t, J=7.5Hz), 2.85-2.95 (1H, m), 3.27 (2H, t, J=5.8Hz), 3.3-3.5 (4H, m), 3.57 (2H, t, J=5.9Hz), 3.6-3.9 (4H, m), 5.0-5.1 (1H, m), 7.0-7.15 (4H, m)

Example 19

3-(β-D-Glucopyranosyloxy)-4-[(4-{3-[2-hydroxy-1-(hydroxy-methyl)ethyl]carbamoylpropyl}phenyl)methyl]-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 1 using 2-amino-1,3-propanediol instead of glycinamide hydrochloride.

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.2 (6H, m), 1.8-1.95 (2H, m), 2.21 (2H, t, J=7.6Hz), 2.58 (2H, t, J=7.6Hz), 2.85-2.95 (1H, m), 3.3-3.45 (4H, m), 3.55-3.95 (9H, m), 5.0-5.1 (1H, m), 7.0-7.15 (4H, m)

Example 20

3-(β-D-Glucopyranosyloxy)-4-[(4-{3-[2-hydroxy-1-hydroxy-methyl-1-(methyl)ethyl]carbamoylpropyl}phenyl)methyl]-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 1 using 2-amino-2-methyl-1,3-propanediol instead of glycinamide hydrochloride.

^{1}H−NMR (CD_3OD) δ ppm:

1.1-1.15 (6H, m), 1.22 (3H, s), 1.8-1.95 (2H, m), 2.19 (2H, t, J=7.7Hz), 2.58 (2H, t, J=7.5Hz), 2.85-2.95 (1H, m), 3.25-3.45 (4H, m), 3.55-3.9 (8H, m), 5.0-5.1 (1H, m), 7.0-7.15 (4H, m)

Example 21

3-(β-D-Glucopyranosyloxy)-4-[(4-{3-[2-hydroxy-1,1-bis-(hydroxymethyl)ethylcarbamoyl]propyl}phenyl)methyl]-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 1 using tris(hydroxymethyl)amino-methane instead of glycinamide hydrochloride.

^{1}H−NMR (CD_3OD) δ ppm:

1.1-1.2 (6H, m), 1.8-1.95 (2H, m), 2.23 (2H, t, J=7.5Hz), 2.59 (2H, t, J=7.6Hz), 2.85-2.95 (1H, m), 3.25-3.45 (4H, m), 3.6-3.9 (10H, m), 5.0-5.1 (1H, m), 7.0-7.15 (4H, m)

Example 22

4-[(4-{3-[(*S*)-1-(Carbamoyl)ethylcarbamoyl]propyl}phenyl)-

methyl]-3-(β-D-glucopyranosyloxy)-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 1 using L-alanine amide hydrochloride instead of glycinamide hydrochloride.

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.2 (6H, m), 1.32 (3H, d, J=7.2Hz), 1.8-1.95 (2H, m), 2.15-2.25 (2H, m), 2.58 (2H, t, J=7.5Hz), 2.85-2.95 (1H, m), 3.25-3.45(4H,m), 3.6-3.9(4H,m), 4.32(1H,q,J=7.2Hz), 5.0-5.1 (1H, m), 7.0-7.15 (4H, m)

Example 23

4-[(4-{3-[(*S*)-1-Carbamoyl-2-hydroxyethylcarbamoyl]propyl}-phenyl)methyl]-3-(β-D-glucopyranosyloxy)-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 1 using L-serine amide hydrochloride instead of glycinamide hydrochloride.

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.2 (6H, m), 1.85-1.95 (2H, m), 2.2-2.3 (2H, m), 2.59 (2H, t, J=7.4Hz), 2.85-2.95 (1H, m), 3.25-3.45 (4H, m), 3.6-3.9 (6H, m), 4.4 (1H, t, J=5.2Hz), 5.0-5.1 (1H, m), 7.05-7.15 (4H, m)

Example 24

4-[(4-{3-[1-Carbamoyl-1-(methyl)ethylcarbamoyl]propyl}-phenyl)methyl]-3-(β-D-glucopyranosyloxy)-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to

that described in Example 1 using 2-amino-2-methylpropionamide instead of glycinamide hydrochloride.

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.2 (6H, m), 1.44 (6H, s), 1.8-1.95 (2H, m), 2.18 (2H, t, J=7.5Hz), 2.58 (2H, t, J=7.4Hz), 2.85-2.95 (1H, m), 3.25-3.45 (4H, m), 3.6-3.9 (4H, m), 5.0-5.1 (1H, m), 7.0-7.15 (4H, m)

Example 25

4-[(4-{3-[2-(Acetylamino)ethylcarbamoyl]propyl}phenyl)-methyl]-3-(β-D-glucopyranosyloxy)-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 1 using *N*-acetylethylenediamine instead of glycinamide hydrochloride.

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.2 (6H, m), 1.8-1.95 (5H, m), 2.16 (2H, t, J=7.6Hz), 2.57 (2H, t, J=7.6Hz), 2.85-2.95 (1H, m), 3.2-3.45 (8H, m), 3.6-3.9 (4H, m), 5.0-5.15 (1H, m), 7.0-7.15 (4H, m)

Example 26

4-({4-[(1*E*)-3-Carbamoylprop-1-enyl]phenyl}methyl)-3-(β-D-glucopyranosyloxy)-5-isopropyl-1*H*-pyrazole

To a solution of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-({4-[(1*E*)-3-carboxyprop-1-enyl]phenyl}-methyl)-5-isopropyl-1*H*-pyrazole (32 mg) in *N*,*N*-dimethylformamide (1 mL) were added ammonium chloride (8 mg), 1-hydroxybenzotriazole (9 mg), 1-ethyl-3-(3-dimethylaminopropyl)carbodiimide hydrochloride (15 mg) and triethylamine (21

mg), and the mixture was stirred at room temperature overnight. The insoluble material was removed by filtration, 5 mol/L aqueous sodium hydroxide solution (0.5 mL) was added to the filtrate, and the resulting mixture was stirred at room temperature for 1 hour. The insoluble material was removed by filtration, and the filtrate was purified by preparative reverse phase column chromatography (Shiseido CAPCELL PAK UG120 ODS, 5 μm, 120 Å, 20 x 50mm, flow rate 30 mL/minute linear gradient, water/acetonitrile = 90/10 - 10/90) to give the title compound (7 mg).

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.2 (6H, m), 2.8-2.95 (1H, m), 3.05-3.15 (2H, m), 3.25-3.45 (4H, m), 3.6-3.9 (4H, m), 5.0-5.15 (1H, m), 6.15-6.35 (1H, m), 6.48 (1H, d, J=15.6Hz), 7.1-7.2 (2H, m), 7.2-7.3 (2H, m)

Example 27

3-(β-D-Glucopyranosyloxy)-4-[(4-{(1*E*)-2-[2-hydroxy-1-hydroxymethyl-1-(methyl)ethylcarbamoyl]vinyl}phenyl)-methyl]-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 26 using 2-amino-2-methyl-1,3-propanediol and 3-(2,3,4,6-tetra-*O*-acetyl-β-D-gluco-pyranosyloxy)-4-({4-[(1*E*)-2-carboxyvinyl]phenyl}methyl)-5-isopropyl-1*H*-pyrazole instead of ammonium chloride and 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-({4-[(1*E*)-3-carboxyprop-1-enyl]phenyl}methyl)-5-isopropyl-1*H*-pyrazole, respectively.

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.2 (6H, m), 1.3 (3H, s), 2.85-2.95 (1H, m), 3.25-3.45 (4H, m), 3.6-3.9 (8H, m), 5.05-5.15 (1H, m), 6.64 (1H, d, J=15.9Hz), 7.2-7.3 (2H, m), 7.4-7.5 (3H, m)

Example 28

3-(β-D-Glucopyranosyloxy)-4-[(4-{(1*E*)-2-[2-hydroxy-1,1-bis-(hydroxymethyl)ethylcarbamoyl]vinyl}phenyl)methyl]-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 26 using tris(hydroxymethyl)-aminomethane and 3-(2,3,4,6-tetra-*O*-acetyl-β-D-gluco-pyranosyloxy)-4-({4-[(1*E*)-2-carboxyvinyl]phenyl}methyl)-5-isopropyl-1*H*-pyrazole instead of ammonium chloride and 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-({4-[(1*E*)-3-carboxyprop-1-enyl]phenyl}methyl)-5-isopropyl-1*H*-pyrazole, respectively.

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.2 (6H, m), 2.85-2.95 (1H, m), 3.25-3.45 (4H, m), 3.67 (1H, dd, J=12.1Hz, 5.3Hz), 3.7-3.9 (9H, m), 5.05-5.15 (1H, m), 6.69 (1H, d, J=15.7Hz), 7.24 (2H, d, J=8.3Hz), 7.45 (2H, d, J=8.3Hz), 7.48 (1H, d, J=15.7Hz)

Example 29

4-[(4-{(1*E*)-2-[1-Carbamoyl-1-(methyl)ethylcarbamoyl]vinyl}-phenyl)methyl]-3-(β-D-glucopyranosyloxy)-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to

that described in Example 26 using 2-amino-2-methylpropionamide and 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-({4-[(1*E*)-2-carboxyvinyl]phenyl}methyl)-5-isopropyl-1*H*-pyrazole instead of ammonium chloride and 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-({4-[(1*E*)-3-carboxyprop-1-enyl]phenyl}methyl)-5-isopropyl-1*H*-pyrazole, respectively.

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.15 (6H, m), 1.52 (6H, s), 2.85-2.95 (1H, m), 3.25-3.45 (4H, m), 3.67 (1H, dd, J=11.9Hz, 5.1Hz), 3.7-3.9 (3H, m), 5.0-5.15 (1H, m), 6.6 (1H, d, J=15.8Hz), 7.24 (2H, d, J=8.4Hz), 7.4-7.5 (3H, m)

Example 30

<u>3-(β-D-Glucopyranosyloxy)-4-[(4-{3-[1-(2-hydroxyethyl-carbamoyl)-1-(methyl)ethylcarbamoyl]propyl}phenyl)methyl]-5-isopropyl-1*H*-pyrazole</u>

To a solution of 2-benzyloxycarbonylamino-2-methyl-propionic acid (0.5 g) in dichloromethane (5 mL) were added 1-ethyl-3-(3-dimethylaminopropyl)carbodiimide hydrochloride (0.61 g), 1-hydroxybenzotriazole (0.43 g) and 2-aminoethanol (1.16 g), and the mixture was stirred at room temperature overnight. To the reaction mixture was added water, and the resulting mixture was extracted with dichloromethane. The organic layer was washed with a saturated aqueous sodium hydrogen carbonate solution and brine successively, and dried over anhydrous sodium sulfate. The solvent was removed under reduced pressure, and the residue was dissolved in methanol (5 mL). To

the solution was added 10% palladium-carbon powder (0.10 g), and the mixture was stirred at room temperature under a hydrogen atmosphere for 4 hours. The insoluble material was removed by filtration, and the solvent of the filtrate was removed under reduced pressure to give 2-(2-amino-2-methylpropionyl-amino)ethanol (0.11 g). To a solution of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-({4-[(1*E*)-3-carboxyprop-1-enyl]phenyl}methyl)-5-isopropyl-1*H*-pyrazole (70 mg) in *N*,*N*-dimethylformamide (0.5 mL) were added 1-ethyl-3-(3-di-methylaminopropyl)carbodiimide hydrochloride (32 mg), 1-hydroxybenzotriazole (23 mg) and 2-(2-amino-2-methyl-propionylamino)ethanol (0.11 g), and the mixture was stirred at room temperature overnight. The insoluble material was removed by filtration, 5 mol/L aqueous sodium hydroxide solution (0.25 mL) was added to the filtrate, and the resulting mixture was stirred at room temperature for 1 hour. To the mixture was added acetic acid (0.09 mL), and the mixture was diluted with water (1 mL). The insoluble material was removed by filtration, and the filtrate was purified by preparative reverse phase column chromatography (Shiseido CAPCELL PAK UG120 ODS, 5 μL, 120 Å, 20 x 50mm, flow rate 30 mL/minute linear gradient, water/methanol = 90/10 - 10/90) to give 3-(β-D-glucopyranosyloxy)-4-(4-{(1*E*)-3-[1-(2-hydroxyethylcarbamoyl)-1-methylethylcarbamoyl]prop-1-enyl}phenyl)methyl)-5-isopropyl-1*H*-pyrazole (14 mg). This material was dissolved in methanol (0.5 mL). To the solution was added 10% palladium-carbon powder (7 mg), and the mixture was stirred at room temperature under a hydrogen atmosphere for

2 hours. The insoluble material was removed by filtration, and the solvent of the filtrate was removed under reduced pressure to give the title compound (11 mg).

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.2 (6H, m), 1.42 (6H, s), 1.8-1.95 (2H, m), 2.19 (2H, t, J=7.6Hz), 2.58 (2H, t, J=7.6Hz), 2.85-2.95 (1H, m), 3.25-3.45 (6H, m), 3.56 (2H, t, J=5.8Hz), 3.6-3.9 (4H, m), 5.0-5.1 (1H, m), 7.0-7.15 (4H, m)

Example 31

4-[(4-{3-[1-Carbamoylmethylcarbamoyl-1-(methyl)ethyl-carbamoyl]propyl}phenyl)methyl]-3-(β-D-glucopyranosyloxy)-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 30 using glycinamide hydrochloride and triethylamine instead of 2-aminoethanol.

^{1}H−NMR (CD_3OD) δ ppm:

1.1-1.2 (6H, m), 1.42 (6H, s), 1.8-1.95 (2H, m), 2.22 (2H, t, J=7.5Hz), 2.58 (2H, t, J=7.7Hz), 2.85-2.95 (1H, m), 3.25-3.45 (4H, m), 3.6-3.9 (6H, m), 5.0-5.1 (1H, m), 7.0-7.15 (4H, m)

Reference Example 6

3-(2,3,4,6-Tetra-*O*-acetyl-β-D-galactopyranosyloxy)-4-[(4-bromophenyl)methyl]-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Reference Example 3 using acetobromo-α-D-galactose instead of acetobromo-α-D-glucose.

^{1}H−NMR ($CDCl_3$) δ ppm:

1.17 (6H, d, J=7.3Hz), 1.88 (3H, s), 1.99 (3H, s), 2.02 (3H, s), 2.17 (3H, s), 2.8-2.95 (1H, m), 3.59 (1H, d, J=16.0Hz), 3.66 (1H, d, J=16.0Hz), 4.05-4.25 (3H, m), 5.1 (1H, dd, J=10.4Hz, 3.5Hz), 5.35-5.45 (2H, m), 5.57 (1H, d, J=8.2Hz), 6.95-7.05 (2H, m), 7.3-7.4 (2H, m)

Reference Example 7

3-(2,3,4,6-Tetra-*O*-acetyl-β-D-galactopyranosyloxy)-4-({4-[(1*E*)-3-carboxyprop-1-enyl]phenyl}methyl)-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Reference Example 4 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-galactopyranosyloxy)-4-[(4-bromophenyl)-methyl]-5-isopropyl-1*H*-pyrazole instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-bromophenyl)methyl]-5-isopropyl-1*H*-pyrazole.

^{1}H−NMR ($CDCl_3$) δ ppm:

1.1-1.2 (6H, m), 1.83 (3H, s), 1.99 (3H, s), 2.00 (3H, s), 2.17 (3H, s), 2.8-2.95 (1H, m), 3.26 (2H, d, J=6.9Hz), 3.6 (1H, d, J=16.2Hz), 3.69 (1H, d, J=16.2Hz), 4.05-4.3 (3H, m), 5.1 (1H, dd, J=10.1Hz, 3.5Hz), 5.3-5.5 (3H, m), 6.2-6.3 (1H, m), 6.45 (1H, d, J=15.9Hz), 7.0-7.1 (2H, m), 7.2-7.3 (2H, m), 10.0-12.0 (1H, br)

Example 32

3-(β-D-Galactopyranosyloxy)-4-[(4-{3-[2-hydroxy-1-hydroxy-

methyl-1-(methyl)ethylcarbamoyl]propyl}phenyl)methyl]-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 1 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-galactopyranosyloxy)-4-({4-[(1*E*)-3-carboxyprop-1-enyl]-phenyl}methyl)-5-isopropyl-1*H*-pyrazole and 2-amino-2-methyl-1,3-propanediol instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-({4-[(1*E*)-3-carboxyprop-1-enyl]-phenyl}methyl)-5-isopropyl-1*H*-pyrazole and glycinamide hydrochloride, respectively.

^{1}H−NMR (CD_3OD) δ ppm:

1.1-1.15 (6H, m), 1.22 (3H, s), 1.8-1.95 (2H, m), 2.19 (2H, t, J=7.4Hz), 2.58 (2H, t, J=7.5Hz), 2.85-2.95 (1H, m), 3.52 (1H, dd, J=9.8Hz, 3.6Hz), 3.55-3.8 (10H, m), 3.85-3.9 (1H, m), 5.05-5.1 (1H, m), 7.0-7.15 (4H, m)

Example 33

4-[(4-{3-[1-Carbamoyl-1-(methyl)ethylcarbamoyl]propyl}-phenyl)methyl]-3-(β-D-galactopyranosyloxy)-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 1 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-galactopyranosyloxy)-4-({4-[(1*E*)-3-carboxyprop-1-enyl]-phenyl}methyl)-5-isopropyl-1*H*-pyrazole and 2-amino-2-methylpropionamide instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-({4-[(1*E*)-3-carboxyprop-1-enyl]-phenyl}methyl)-5-isopropyl-1*H*-pyrazole and glycinamide

hydrochloride, respectively.

^{1}H—NMR (CD_3OD) δ ppm:

1.1-1.15 (6H, m), 1.44 (6H, s), 1.8-1.95 (2H, m), 2.19 (2H, t, J=7.6Hz), 2.57 (2H, t, J=7.6Hz), 2.85-2.95 (1H, m), 3.52 (1H, dd, J=9.7Hz, 3.4Hz), 3.55-3.65 (1H, m), 3.65-3.8 (5H, m), 3.85-3.9 (1H, m), 5.0-5.1 (1H, m), 7.0-7.15 (4H, m)

Example 34

4-({4-[3-(2-Aminoethylsulfamoyl)propyl]phenyl}methyl)-3-(β-D-glucopyranosyloxy)-5-isopropyl-1*H*-pyrazole

A suspension of sodium allylsulfonate (2.0 g) in thionyl chloride (10.4 mL) was heated at 70°C and stirred for 1.5 days. The insoluble material was removed by filtration, and the solvent of the filtrate was removed under reduced pressure. The obtained residue was dissolved in dry tetrahydrofuran (10 mL), and the solvent was removed under reduced pressure. The obtained residue was again dissolved in dry tetrahydrofuran (10 mL), and the solvent was removed under reduced pressure to give allylsulfonyl chloride (1.26 g). To a suspension of *N*-benzyloxycarbonyl-1,2-diaminoethane hydrochloride (0.82 g) and triethylamine (0.63 g) in dichloromethane (5 mL) was added allylsulfonyl chloride (0.25 g) at room temperature, and the mixture was stirred overnight. The reaction was quenched by addition of water, and the organic layer of the resulting mixture was separated. The organic layer was washed with 1 mol/L hydrochloric acid, a saturated aqueous sodium hydrogen carbonate solution and brine successively, and dried over anhydrous sodium

sulfate. The solvent was removed under reduced pressure to give *N*-(2-benzyloxycarbonylaminoethyl)allylsulfonamide (82 mg). This material was dissolved in acetonitrile (0.25 mL). To the solution were added 3-(2,3,4,6-tetra-*O*-acetyl-β-D-gluco-pyranosyloxy)-4-[(4-bromophenyl)methyl]-5-isopropyl-1*H*-pyrazole (70 mg), triethylamine (57 mg), palladium acetate (II) (3 mg) and tris(2-methylphenyl)phosphine (7 mg), and the mixture was refluxed overnight under shading the light. The solvent was removed under reduced pressure, and the residue was dissolved in methanol (0.5 mL). To this solution was added 5 mol/L aqueous sodium hydroxide solution (0.25 mL), and the mixture was stirred at room temperature for 1 hour. The insoluble material was removed by filtration, and the filtrate was purified by preparative reverse phase column chromatography (Shiseido CAPCELL PAK UG120 ODS, 5 μL, 120 Å, 20 x 50mm, flow rate 30 mL/minute linear gradient, water/methanol = 90/10 - 10/90) to give 4-({4-[(1*E*)-3-(2-benzyloxycarbonylaminoethylsulfamoyl)-prop-1-enyl]phenyl}methyl)-3-(ß-D-glucopyranosyloxy)-5-isopropyl-1*H*-pyrazole (14 mg). This material was dissolved in methanol (0.5 mL). To the solution was added 10% palladium-carbon powder (5 mg), and the mixture was stirred at room temperature under a hydrogen atmosphere for 3 hours. The insoluble material was removed by filtration, and the solvent of the filtrate was removed under reduced pressure to give the title compound (10 mg).

^{1}H−NMR (CD_3OD) δ ppm:

1.1-1.2 (6H, m), 2.0-2.1 (2H, m), 2.65-2.75 (4H, m), 2.85-2.95

(1H, m), 2.95-3.05 (4H, m), 3.25-3.45 (4H, m), 3.6-3.9 (4H, m), 5.0-5.1 (1H, m), 7.05-7.2 (4H, m)

Example 35

4-[(4-{3-[1-Carbamoyl-1-(methyl)ethylsulfamoyl]propyl}-phenyl)methyl]-3-(β-D-glucopyranosyloxy)-5-isopropyl-1*H*-pyrazole

To a suspension of benzyl 2-amino-2-methylpropionate *p*-toluenesulfonic acid salt (Tetrahedron, 1991, Vol.47, No.2, pp.259-270; 3.9 g) and triethylamine (2.7 g) in dichloromethane (15 mL) was added allylsulfonyl chloride (0.75 g) at room temperature, and the mixture was stirred overnight. The reaction was quenched by addition of water, and the organic layer of the resulting mixture was separated. The organic layer was washed with 1 mol/L hydrochloric acid, a saturated aqueous sodium hydrogen carbonate solution and brine successively, and dried over anhydrous sodium sulfate. The solvent was removed under reduced pressure to give *N*-[1-benzyloxycarbonyl-1-(methyl)-ethyl] allylsulfonamide (0.48 g). To a solution of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-bromophenyl)-methyl]-5-isopropyl-1*H*-pyrazole (0.40 g), *N*-[1-benzyloxy-carbonyl-1-(methyl)ethyl] allylsulfonamide (0.48 g) in acetonitrile (1 mL) were added triethylamine (0.32 g), palladium acetate (II) (14 mg) and tris(2-methylphenyl)phosphine (39 mg), and the mixture was refluxed overnight under shading the light. The solvent was removed under reduced pressure, and the residue was purified by column chromatography on silica gel (eluent:

n-hexane/ethyl acetate = 1/1 - ethyl acetate) to give 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-{(1*E*)-3-[1-benzyloxycarbonyl-1-(methyl)ethylsulfamoyl]prop-1-enyl}phenyl)methyl]-5-isopropyl-1*H*-pyrazole (0.11 g). This material was dissolved in methanol (1 mL). To the solution was added 10% palladium-carbon powder (50 mg), and the mixture was stirred at room temperature under a hydrogen atmosphere for 2 hours. The insoluble material was removed by filtration, and the solvent of the filtrate was removed under reduced pressure to give 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-{3-[1-carboxy-1-(methyl)ethylsulfamoyl]propyl}phenyl)-methyl]-5-isopropyl-1*H*-pyrazole (95 mg). To a solution of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-{3-[1-carboxy-1-(methyl)ethylsulfamoyl]propyl}phenyl)methyl]-5-isopropyl-1*H*-pyrazole (50 mg) in *N*,*N*-dimethylformamide (0.5 mL) were added 1-ethyl-3-(3-dimethylaminopropyl)carbodiimide hydrochloride (19 mg) and 1-hydroxybenzotriazole (13 mg). An ammonia gas was bubbled into the mixture for about 2 minutes, and the resulting mixture was stirred at room temperature overnight. The insoluble material was removed by filtration. To the filtrate was added 5 mol/L aqueous sodium hydroxide solution (0.25 mL), and the mixture was stirred at room temperature for 1 hour. To the reaction mixture was added acetic acid (0.09 mL), and the mixture was diluted with water (1 mL). The insoluble material was removed by filtration, and the filtrate was purified by preparative reverse phase column chromatography (Shiseido CAPCELL PAK UG120 ODS, 5 μL, 120 Å,

20 x 50mm, flow rate 30 mL/minute linear gradient, water/methanol= 90/10 - 10/90) to give the title compound (14 mg).

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.2 (6H, m), 1.43 (6H, s), 2.0-2.15 (2H, m), 2.7 (2H, t, J=7.4Hz), 2.8-2.95 (1H, m), 2.95-3.1 (2H, m), 3.25-3.45 (4H, m), 3.6-3.9 (4H, m), 5.0-5.15 (1H, m), 7.05-7.2 (4H, m)

Reference Example 8

Benzyl hydroxypivalate

To a suspension of hydroxypivalic acid (3 g) and potassium carbonate (3.9 g) in *N*,*N*-dimethylformamide (25 mL) was added benzyl bromide (2.9 mL), and the mixture was stirred at room temperature for 5 hours. The reaction mixture was poured into water, and the resulting mixture was extracted with diethyl ether. The organic layer was washed with water twice and dried over anhydrous magnesium sulfate. The solvent was removed under reduced pressure to give the title compound (4.7 g).

^{1}H−NMR ($CDCl_3$) δ ppm:

1.22 (6H, s), 2.33 (1H, t, J=6.7Hz), 3.58 (2H, d, J=6.7Hz), 5.15 (2H, s), 7.3-7.4 (5H, m)

Reference Example 9

4-(2-Benzyloxycarbonyl-2-methylpropoxy)benzaldehyde

To a solution of 4-hydroxybenzaldehyde (2.7 g), benzyl hydroxypivalate (4.7 g) and triphenylphosphine (6.4 g) in tetrahydrofuran (22 mL) was added diethyl azodicarboxylate (40% toluene solution, 11 mL), and the mixture was stirred at room

temperature for 2 days. The reaction mixture was poured into water, and the resulting mixture was extracted with diethyl ether. The organic layer was washed with water and dried over anhydrous magnesium sulfate. The solvent was removed under reduced pressure, and the residue was purified by column chromatography on silica gel (eluent: *n*-hexane/ethyl acetate = 6/1 - 4/1) to give the title compound (0.97 g).

^{1}H−NMR ($CDCl_3$) δ ppm:

1.36 (6H, s), 4.07 (2H, s), 5.15 (2H, s), 6.9-7.0 (2H, m), 7.2-7.35 (5H, m), 7.75-7.85 (2H, m), 9.89 (1H, s)

Reference Example 10

[4-(2-Benzyloxycarbonyl-2-methylpropoxy)phenyl]methanol

To a solution of 4-(2-benzyloxycarbonyl-2-methyl-propoxy)benzaldehyde (0.97 g) in tetrahydrofuran (20 mL) was added sodium borohydride (59 mg), and the mixture was stirred at room temperature for 3 hours. The reaction mixture was poured into 0.5 mol/L hydrochloric acid, and the resulting mixture was extracted with diethyl ether. The organic layer was washed with water and brine successively, and dried over anhydrous magnesium sulfate. The solvent was removed under reduced pressure, and the residue was purified by column chromatography on silica gel (eluent: *n*-hexane/ethyl acetate = 6/1 - 3/2) to give the title compound (0.95 g).

^{1}H−NMR ($CDCl_3$) δ ppm:

1.34 (6H, s), 1.51 (1H, t, J=5.9Hz), 3.99 (2H, s), 4.62 (2H, d, J=5.9Hz), 5.15 (2H, s), 6.8-6.9 (2H, m), 7.25-7.35 (7H, m)

Reference Example 11

4-{[4-(2-Benzyloxycarbonyl-2-methylpropoxy)phenyl]methyl}-1,2-dihydro-5-isopropyl-3*H*-pyrazol-3-one

To a solution of [4-(2-benzyloxycarbonyl-2-methyl-propoxy)phenyl]methanol (0.95 g) in tetrahydrofuran (8 mL) were added triethylamine (0.48 mL) and methansulfonyl chloride (0.26 mL) under ice-cooling, and the mixture was stirred for 1 hour. The insoluble material was removed by filtration. The obtained solution of [4-(2-benzyloxycarbonyl-2-methylpropoxy)-phenyl]methyl mesylate in tetrahydrofuran was added to a suspension of sodium hydride (60%, 139 mg) and ethyl 4-methyl-3-oxopentanoate (0.52g) in tetrahydrofuran (15 mL), and the mixture was heated for reflux for 15 hours. To the reaction mixture was added 1 mol/L hydrochloric acid, and the resulting mixture was extracted with diethyl ether. The organic layer was washed with water and dried over anhydrous magnesium sulfate. The solvent was removed under reduced pressure. To a solution of the residue in ethanol (10 mL) was added hydrazine monohydrate (0.16 mL), and the mixture was stirred at room temperature for 2 days. The reaction mixture was concentrated under reduced pressure, and the residue was purified by column chromatography on silica gel (eluent: dichloromethane/methanol = 30/1 - 20/1) to give the title compound (0.25 g).

^{1}H—NMR ($CDCl_3$) δ ppm:

1.15 (6H, d, J=6.9Hz), 1.32 (6H, s), 2.85-2.95 (1H, m), 3.66 (2H, s), 3.94 (2H, s), 5.13 (2H, s), 6.7-6.8 (2H, m), 7.05-7.15

(2H, m), 7.2-7.35 (5H, m)

Reference Example 12

3-(2,3,4,6-Tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-{[4-(2-benzyloxycarbonyl-2-methylpropoxy)phenyl]methyl}-5-isopropyl-1*H*-pyrazole

To a solution of 4-{[4-(2-benzyloxycarbonyl-2-methylpropoxy)phenyl]methyl}-1,2-dihydro-5-isopropyl-3*H*-pyrazol-3-one (0.25 g), acetobromo-α-D-glucose (0.48 g) and benzyltri(*n*-butyl)ammonium chloride (0.18 g) in dichloromethane (5 mL) was added 5 mol/L aqueous sodium hydroxide solution (0.35 mL), and the mixture was stirred at room temperature for 3 hours. The reaction mixture was purified by column chromatography on aminopropylated silica gel (eluent: *n*-hexane/ethyl acetate = 1/1 - 1/3) to give the title compound (0.28 g).

^{1}H−NMR ($CDCl_3$) δ ppm:

1.16 (6H, d, J=7.1Hz), 1.32 (6H, s), 1.86 (3H, s), 2.01 (3H, s), 2.03 (3H, s), 2.06 (3H, s), 2.85-2.95 (1H, m), 3.56 (1H, d, J=16.0Hz), 3.62 (1H, d, J=16.0Hz), 3.8-3.9 (1H, m), 3.92 (1H, d, J=8.7Hz), 3.94 (1H, d, J=8.7Hz), 4.15 (1H, dd, J=12.5Hz, 2.4Hz), 4.31 (1H, dd, J=12.5Hz, 4.2Hz), 5.13 (2H, s), 5.15-5.3 (3H, m), 5.55-5.65 (1H, m), 6.7-6.75 (2H, m), 6.95-7.05 (2H, m), 7.25-7.35 (5H, m)

Reference Example 13

3-(2,3,4,6-Tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-{[4-(2-carboxy-2-methylpropoxy)phenyl]methyl}-5-isopropyl-1*H*-

pyrazole

3-(2,3,4,6-Tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-{[4-(2-benzyloxycarbonyl-2-methylpropoxy)phenyl]methyl}-5-isopropy-1*H*—pyrazole (0.28 g) was dissolved in methanol (6 mL). To the solution was added 10% palladium-carbon powder (54 mg), and the mixture was stirred at room temperature under a hydrogen atmosphere overnight. The insoluble material was removed by filtration, and the solvent of the filtrate was removed under reduced pressure to give the title compound (0.25 g).

^{1}H—NMR ($CDCl_3$) δ ppm:

1.16 (6H, d, J=6.7Hz), 1.33 (6H, s), 1.88 (3H, s), 2.01 (3H, s), 2.03 (3H, s), 2.05 (3H, s), 2.85-3.0 (1H, m), 3.54 (1H, d, J=15.8Hz), 3.6 (1H, d, J=15.8Hz), 3.8-3.9 (1H, m), 3.91 (1H, d, J=8.8Hz), 3.93 (1H, d, J=8.8Hz), 4.15 (1H, dd, J=12.5Hz, 2.0Hz), 4.32 (1H, dd, J=12.5H, 4.0Hz), 5.15-5.3 (3H, m), 5.4-5.45 (1H, m), 6.7-6.8 (2H, m), 6.95-7.05 (2H, m)

Example 36

3-(2,3,4,6-Tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-{2-[(*S*)-1-(carbamoyl)ethylcarbamoyl]-2-methylpropoxy}phenyl)-methyl]-5-isopropyl-1*H*-pyrazole

To a solution of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-gluco-pyranosyloxy)-4-{[4-(2-carboxy-2-methylpropoxy)phenyl]-methyl}-5-isopropyl-1*H*-pyrazole (0.13 g) in *N*,*N*-dimethyl-formamide (2 mL) were added L-alanine amide hydrochloride (46 mg), triethylamine (0.08 mL), 1-hydroxybenzotriazole (38 mg) and 1-ethyl-3-(3-dimethylaminopropyl)carbodiimide

hydrochloride (0.11 g), and the mixture was stirred at room temperature overnight. The reaction mixture was poured into water, and the resulting mixture was extracted with ethyl acetate. The organic layer was washed with water, a saturated aqueous sodium hydrogen carbonate solution, water and brine successively, and dried over anhydrous magnesium sulfate. The solvent was removed under reduced pressure, and the residue was purified by column chromatography on silica gel (eluent: dichloromethane/methanol = 20/1 - 10/1) to give the title compound (0.14 g).

^{1}H−NMR ($CDCl_3$) δ ppm:

1.1-1.2 (6H, m), 1.29 (3H, s), 1.32 (3H, s), 1.38 (3H, d, J=7.5Hz), 1.89 (3H, s), 2.01 (3H, s), 2.03 (3H, s), 2.06 (3H, s), 2.85-2.95 (1H, m), 3.57 (1H, d, J=16.0Hz), 3.62 (1H, d, J=16.0Hz), 3.8-3.9 (2H, m), 3.94 (1H, d, J=9.1Hz), 4.14 (1H, dd, J=12.5Hz, 2.4Hz), 4.3 (1H, dd, J=12.5Hz, 4.1Hz), 4.4-4.55 (1H, m), 5.15-5.4 (4H, m), 5.58 (1H, d, J=8.0Hz), 6.2-6.35 (1H, br), 6.67 (1H, d, J=7.3Hz), 6.7-6.8 (2H, m), 7.0-7.1 (2H, m)

Example 37

3-(2,3,4,6-Tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-{2-[2-hydroxy-1,1-di(methyl)ethylcarbamoyl]-2-methylpropoxy}-phenyl)methyl]-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 36 using 2-amino-2-methyl-1-propanol instead of L-alanine amide hydrochloride.

^{1}H−NMR (CD_3OD) δ ppm:

1.1-1.2 (6H, m), 1.25 (6H, s), 1.27 (6H, s), 1.89 (3H, s), 1.97 (3H, s), 2.01 (3H, s), 2.02 (3H, s), 2.85-3.0 (1H, m), 3.5 (2H, s), 3.6 (2H, s), 3.89 (2H, s), 3.9-4.0 (1H, m), 4.11 (1H, dd, J=12.3Hz, 2.2Hz), 4.3 (1H, dd, J=12.3Hz, 4.0Hz), 5.05-5.15 (2H, m), 5.25-5.35 (1H, m), 5.48 (1H, d, J=7.9Hz), 6.75-6.9 (3H, m), 7.0-7.1 (2H, m)

Example 38

3-(2,3,4,6-Tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-{2-[1-carbamoyl-1-(methyl)ethylcarbamoyl]-2-methylpropoxy}-phenyl)methyl]-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 36 using 2-amino-2-methylpropionamide instead of L-alanine amide hydrochloride.

^{1}H—NMR (CD_3OD) δ ppm:

1.1-1.2 (6H, m), 1.27 (6H, s), 1.49 (6H, s), 1.89 (3H, s), 1.97 (3H, s), 2.01 (3H, s), 2.02 (3H, s), 2.85-3.0 (1H, m), 3.6 (2H, s), 3.9-4.0 (3H, m), 4.11 (1H, dd, J=12.3Hz, 2.4Hz), 4.3 (1H, dd, J=12.3Hz, 4.0Hz), 5.05-5.15 (2H, m), 5.25-5.35 (1H, m), 5.48 (1H, d, J=8.4Hz), 6.75-6.85 (2H, m), 7.0-7.1 (2H, m)

Example 39

4-[(4-{2-[(*S*)-1-(Carbamoyl)ethylcarbamoyl]-2-methyl-propoxy}phenyl)methyl]-3-(β-D-glucopyranosyloxy)-5-isopropyl-1*H*-pyrazole

To a solution of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-gluco-pyranosyloxy)-4-[(4-{2-[(*S*)-1-(carbamoyl)ethylcarbamoyl]-2-

methylpropoxy}phenyl)methyl]-5-isopropyl-1*H*-pyrazole (0.14 g) in methanol (4 mL) was added sodium methoxide (28% methanol solution, 0.04 mL), and the mixture was stirred at room temperature for 1 hour. The reaction mixture was concentrated under reduced pressure, and the residue was purified by solid phase extraction on ODS (washing solvent: distilled water, eluent: methanol) to give the title compound (94 mg).

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.15(6H,m),1.29(3H,s),1.3(3H,s),1.35(3H,d,J=7.5Hz), 2.8-2.95 (1H, m), 3.25-3.45 (4H, m), 3.6-3.8 (3H, m), 3.8-3.9 (1H,m),3.94(2H,s),4.3-4.45(1H,m),5.0-5.1(1H,m),6.75-6.85 (2H, m), 7.05-7.15 (2H, m)

Example 40

3-(β-D-Glucopyranosyloxy)-4-[(4-{2-[2-hydroxy-1,1-di-(methyl)ethylcarbamoyl]-2-methylpropoxy}phenyl)methyl]-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 39 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-{2-[2-hydroxy-1,1-(dimethyl)-ethylcarbamoyl]-2-methylpropoxy}phenyl)methyl]-5-isopropyl-1*H*-pyrazole instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-{2-[(*S*)-1-(carbamoyl)ethylcarbamoyl]-2-methylpropoxy}phenyl)methyl]-5-isopropyl-1*H*-pyrazole.

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.15 (6H, m), 1.25 (6H, s), 1.27 (6H, s), 2.8-2.95 (1H, m), 3.25-3.45 (4H, m), 3.5 (2H, s), 3.6-3.7 (2H, m), 3.74 (1H,

d, J=16.0Hz), 3.8-3.95 (3H, m), 5.0-5.15 (1H, m), 6.75-6.9 (2H, m), 7.05-7.15 (2H, m)

Example 41

4-[(4-{2-[1-Carbamoyl-1-(methyl)ethylcarbamoyl]-2-methylpropoxy}phenyl)methyl]-3-(β-D-glucopyranosyloxy)-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 39 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-{2-[1-carbamoyl-1-(methyl)-ethylcarbamoyl]-2-methylpropoxy}phenyl)methyl]-5-isopropyl-1*H*-pyrazole instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-{2-[(*S*)-1-(carbamoyl)ethylcarbamoyl]-2-methylpropoxy}phenyl)methyl]-5-isopropyl-1*H*-pyrazole.

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.15 (6H, m), 1.27 (6H, s), 1.49 (6H, s), 2.8-2.95 (1H, m), 3.25-3.45 (4H, m), 3.6-3.8 (3H, m), 3.8-3.9 (1H, m), 3.93 (2H, s), 5.0-5.1 (1H, m), 6.75-6.85 (2H, m), 7.05-7.15 (2H, m)

Example 42

3-(β-D-Glucopyranosyloxy)-4-{[4-(3-{1-[2-hydroxy-1-(hydroxymethyl)ethylcarbamoyl]-1-(methyl)ethylcarbamoyl}-propyl)phenyl]methyl}-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 30 using 2-amino-1,3-propanediol instead of 2-aminoethanol.

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.2 (6H, m), 1.43 (6H, s), 1.8-1.95 (2H, m), 2.19 (2H, t, J=7.5Hz), 2.58 (2H, t, J=7.5Hz), 2.85-2.95 (1H, m), 3.25-3.45 (4H, m), 3.5-3.95 (9H, m), 5.0-5.15 (1H, m), 7.0-7.2 (4H, m)

Example 43

3-(β-D-Glucopyranosyloxy)-4-{[4-(3-{1-[2-hydroxy-1,1-bis-(hydroxymethyl)ethylcarbamoyl]-1-(methyl)ethylcarbamoyl}-propyl)phenyl]methyl}-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 30 using tris(hydroxymethyl)-aminomethane instead of 2-aminoethanol.

^{1}H—NMR (CD_3OD) δ ppm:

1.05-1.2 (6H, m), 1.42 (6H, s), 1.8-1.95 (2H, m), 2.18 (2H, t, J=7.5Hz), 2.58 (2H, t, J=7.5Hz), 2.85-3.0 (1H, m), 3.25-3.45 (4H, m), 3.6-3.9 (10H, m), 5.0-5.15 (1H, m), 7.0-7.2 (4H, m)

Reference Example 14

4-Bromo-2-methylbenzyl alcohol

To a solution of 4-bromo-2-methylbenzoic acid (10 g) in tetrahydrofuran (60 mL) was added borane-dimethylsulfide complex (7.07 g) under ice-cooling. The reaction mixture was stirred at room temperature for 5 minutes, and stirred at 75°C for 2 days. The reaction mixture was cooled to room temperature. A saturated aqueous potassium carbonate solution was added to the reaction mixture, and the organic layer was separated. The organic layer was washed with water and brine, and dried over anhydrous magnesium sulfate. The solvent was removed under

reduced pressure to give the title compound (9.0 g).

^{1}H−NMR ($CDCl_3$) δ ppm:

1.55-1.65 (1H, m), 2.36 (3H, s), 4.64 (2H, d, J=5.4Hz), 7.2-7.25 (1H, m), 7.3-7.35 (2H, m)

Reference Example 15

4-[(4-Bromo-2-methylphenyl)methyl]-1,2-dihydro-5-isopropyl-3*H*-pyrazol-3-one

To a solution of 4-bromo-2-methylbenzyl alcohol (9.0 g) in dichloromethane (50 mL) was added thionyl chloride (3.8 mL) under ice-cooling, and the reaction mixture was stirred at room temperature overnight. The reaction mixture was concentrated under reduced pressure to give 4-bromo-2-methylbenzyl chloride (9.8 g). To a suspension of sodium hydride (60%, 2.1 g) in tetrahydrofuran (90 mL) was added ethyl 4-methyl-3-oxo-pentanoate (7.5 g) under ice-cooling, and the reaction mixture was stirred at room temperature for 1 hour. 4-Bromo-2-methyl-benzyl chloride (9.8 g) was added to the reaction mixture, and the resulting mixture was stirred at 70°C for 3 days. The reaction mixture was poured into a saturated aqueous ammonium chloride solution, and the mixture was extracted with diethyl ether. The organic layer was washed with water and brine, and dried over anhydrous magnesium sulfate. The solvent was removed under reduced pressure. To a solution of the residue in toluene (20 mL) was added hydrazine monohydrate (5.4 mL), and the mixture was stirred at 90°C overnight. The reaction mixture was concentrated under reduced pressure, and the residue was treated

with *n*-hexane-diethyl ether (10/1) to crystallize. The crystals were collected by filtration and washed with *n*-hexane, water and *n*-hexane successively, and dried under reduced pressure to give the title compound (12.4 g).

^{1}H—NMR (DMSO-d_6) δ ppm:

1.05 (6H, d, J=6.8Hz), 2.28 (3H, s), 2.65-2.8 (1H, m), 3.45 (2H, s), 6.82 (1H, d, J=8.2Hz), 7.24 (1H, dd, J=8.2Hz, 1.8Hz), 7.33 (1H, d, J=1.8Hz), 8.5-12.0 (2H, br)

Reference Example 16

3-(2,3,4,6-Tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-bromo-2-methylphenyl)methyl]-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Reference Example 3 using 4-[(4-bromo-2-methylphenyl)methyl]-1,2-dihydro-5-isopropyl-3*H*-pyrazol-3-one instead of 4-[(4-bromophenyl)methyl]-1,2-dihydro-5-isopropyl-3*H*-pyrazol-3-one.

^{1}H—NMR ($CDCl_3$) δ ppm:

1.1-1.2 (6H, m), 1.81 (3H, s), 1.99 (3H, s), 2.02 (3H, s), 2.06 (3H, s), 2.28 (3H, s), 2.75-2.9 (1H, m), 3.49 (1H, d, J=16.7Hz), 3.59 (1H, d, J=16.7Hz), 3.8-3.9 (1H, m), 4.05-4.2 (1H, m), 4.3 (1H, dd, J=12.4Hz, 4.0Hz), 5.1-5.3 (3H, m), 5.5-5.6 (1H, m), 6.76 (1H, d, J=8.2Hz), 7.1-7.2 (1H, m), 7.25-7.3 (1H, m)

Reference Example 17

3-(2,3,4,6-Tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-({4-[(1*E*)-3-carboxyprop-1-enyl]-2-methylphenyl}methyl)-5-

isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Reference Example 4 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-bromo-2-methylphenyl)-methyl]-5-isopropyl-1*H*-pyrazole instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-bromophenyl)methyl]-5-isopropyl-1*H*-pyrazole.

^{1}H−NMR ($CDCl_3$) δ ppm:

1.1-1.2 (6H, m), 1.78 (3H, s), 1.99 (3H, s), 2.02 (3H, s), 2.06 (3H, s), 2.29 (3H, s), 2.75-2.9 (1H, m), 3.13 (2H, d, J=7.3Hz), 3.54 (1H, d, J=16.8Hz), 3.64 (1H, d, J=16.8Hz), 3.8-3.9 (1H, m), 4.05-4.15 (1H, m), 4.25-4.35 (1H, m), 5.1-5.3 (3H, m), 5.5-5.6 (1H, m), 6.15-6.25 (1H, m), 6.46 (1H, d, J=16.1Hz), 6.85 (1H, d, J=7.9Hz), 7.05 (1H, d, J=7.9Hz), 7.15 (1H, s)

Reference Example 18

3-(2,3,4,6-Tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-({4-[(1*E*)-2-carboxyvinyl]-2-methylphenyl}methyl)-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Reference Example 4 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-bromo-2-methyl-phenyl)methyl]-5-isopropyl-1*H*-pyrazole and acrylic acid instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-bromophenyl)methyl]-5-isopropyl-1*H*-pyrazole and 3-butenoic acid, respectively.

^{1}H−NMR ($CDCl_3$) δ ppm:

1.1-1.2 (6H, m), 1.73 (3H, s), 1.99 (3H, s), 2.04 (3H, s), 2.06 (3H, s), 2.35 (3H, s), 2.8-2.9 (1H, m), 3.58 (1H, d, J=17.2Hz), 3.69 (1H, d, J=17.2Hz), 3.85-3.95 (1H, m), 4.21 (1H, dd, J=12.4Hz, 2.2Hz), 4.35 (1H, dd, J=12.4Hz, 3.9Hz), 5.15-5.3 (3H, m), 5.45 (1H, d, J=7.8Hz), 6.4 (1H, d, J=15.8Hz), 6.93 (1H, d, J=7.8Hz), 7.2-7.3 (1H, m), 7.3-7.4 (1H, m), 7.69 (1H, d, J=15.8Hz)

Example 44

4-[(4-{3-[1-Carbamoyl-1-(methyl)ethylcarbamoyl]propyl}-2-methylphenyl)methyl]-3-(β-D-glucopyranosyloxy)-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 1 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-({4-[(1*E*)-3-carboxyprop-1-enyl]-2-methylphenyl}methyl)-5-isopropyl-1*H*-pyrazole and 2-amino-2-methylpropionamide instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-({4-[(1*E*)-3-carboxyprop-1-enyl]-phenyl}methyl)-5-isopropyl-1*H*-pyrazole and glycinamide hydrochloride, respectively.

^{1}H−NMR (CD_3OD) δ ppm:

1.1-1.2 (6H, m), 1.44 (6H, s), 1.8-1.9 (2H, m), 2.2 (2H, t, J=7.6Hz), 2.3 (3H, S), 2.55 (2H, t, J=7.6Hz), 2.75-2.9 (1H, m), 3.2-3.4 (4H, m), 3.6-3.9 (4H, m), 4.95-5.1 (1H, m), 6.8-6.9 (2H, m), 6.9-7.0 (1H, m)

Example 45

4-[(4-{(1*E*)-2-[1-Carbamoyl-1-(methyl)ethylcarbamoyl]vinyl}-

2-methylphenyl)methyl]-3-(β-D-glucopyranosyloxy)-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 26 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-({4-[(1*E*)-2-carboxyvinyl]-2-methylphenyl}methyl)-5-isopropyl-1*H*-pyrazole and 2-amino-2-methylpropionamide instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-({4-[(1*E*)-3-carboxyprop-1-enyl]-phenyl}methyl)-5-isopropyl-1*H*-pyrazole and ammonium chloride, respectively.

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.15 (6H, m), 1.52 (6H, s), 2.36 (3H, s), 2.75-2.9 (1H, m), 3.2-3.4 (4H, m), 3.6-3.85 (4H, m), 5.0-5.1 (1H, m), 6.58 (1H, d, J=15.8Hz), 7.0 (1H, d, J=7.9Hz), 7.2-7.3 (1H, m), 7.33 (1H, s), 7.43 (1H, d, J=15.8Hz)

Example 46

3-(β-D-Glucopyranosyloxy)-4-[(4-{(1*E*)-2-[2-hydroxy-1-hydroxymethyl-1-(methyl)ethylcarbamoyl]vinyl}-2-methylphenyl)methyl]-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 26 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-({4-[(1*E*)-2-carboxyvinyl]-2-methylphenyl}methyl)-5-isopropyl-1*H*-pyrazole and 2-amino-2-methyl-1,3-propanediol instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-({4-[(1*E*)-3-carboxyprop-1-enyl]-phenyl}methyl)-5-isopropyl-1*H*-pyrazole and ammonium chloride,

respectively.

^{1}H—NMR (CD_3OD) δ ppm:

1.05 -1.15 (6H, m), 1.3 (3H, s), 2.36 (3H, s), 2.75-2.9 (1H, m), 3.25-3.45 (4H, m), 3.6-3.85 (8H, m), 5.04 (1H, d, J=6.1Hz), 6.62 (1H, d, J=15.5Hz), 6.99 (1H, d, J=7.6Hz), 7.26 (1H, d, J=7.6Hz), 7.32 (1H, s), 7.42 (1H, d, J=15.5Hz)

Example 47

3-(β-D-Glucopyranosyloxy)-5-isopropyl-4-[(4-{(1*E*)-2-[2-(sulfamoylamino)ethylcarbamoyl]vinyl}-2-methylphenyl)-methyl]-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 26 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-({4-[(1*E*)-2-carboxyvinyl]-2-methylphenyl}methyl)-5-isopropyl-1*H*-pyrazole and *N*-sulfamoylethylenediamine instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-({4-[(1*E*)-3-carboxyprop-1-enyl]phenyl}methyl)-5-isopropyl-1*H*-pyrazole and ammonium chloride, respectively.

^{1}H—NMR (CD_3OD) δ ppm:

1.05 -1.2 (6H, m), 2.36 (3H, s), 2.75-2.9 (1H, m), 3.19 (2H, t, J=6.3Hz), 3.25-3.4 (4H, m), 3.47 (2H, t, J=6.3Hz), 3.6-3.7 (1H, m), 3.7-3.9 (3H, m), 5.04 (1H, d, J=7.3Hz), 6.54 (1H, d, J=15.7Hz), 7.0 (1H, d, J=7.9Hz), 7.27 (1H, d, J=7.9Hz), 7.33 (1H, s), 7.47 (1H, d, J=15.7Hz)

Reference Example 19

3-(2,3,4,6-Tetra-*O*-acetyl-β-D-galactopyranosyloxy)-4-[(4-{3-[1-carboxy-1-(methyl)ethylcarbamoyl]propyl}phenyl)-methyl]-5-isopropyl-1*H*-pyrazole

To a solution of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-galacto-pyranosyloxy)-4-({4-[(1*E*)-3-carboxyprop-1-enyl]phenyl}-methyl)-5-isopropyl-1*H*-pyrazole (0.4 g) in *N*,*N*-dimethyl-formamide (2 mL) were added 1-ethyl-3-(3-dimethylaminopropyl)-carbodiimide hydrochloride (0.18 g), 1-hydroxybenzotriazole (0.13 g), benzyl 2-amino-2-methylpropionate *p*-toluenesulfonic acid salt (1.16 g) and triethylamine (0.64 g) at room temperature, and the mixture was stirred overnight. To the reaction mixture was added water, and the resulting mixture was extracted with dichloromethane. The organic layer was washed with water and brine, and dried over anhydrous sodium sulfate. The solvent was removed under reduced pressure, and the residue was purified by column chromatography on silica gel (eluent: *n*-hexane/ethyl acetate = 1/1 - ethyl acetate) to give 3-(2,3,4,6-tetra-*O*-acetyl-β-D-galactopyranosyloxy)-4-[(4-{(1*E*)-3-[1-benzyloxy-carbonyl-1-(methyl)ethylcarbamoyl]prop-1-enyl}phenyl)-methyl]-5-isopropyl-1*H*-pyrazole (0.18 g). This material was dissolved in methanol (2 mL). To the solution was added 10% palladium-carbon powder (50 mg), and the mixture was stirred at room temperature under a hydrogen atmosphere for 4 hours. The insoluble material was removed by filtration, and the solvent of the filtrate was removed under reduced pressure to give the title compound (0.15 g).

^{1}H−NMR ($CDCl_3$) δ ppm:

1.05-1.2 (6H, m), 1.57 (3H, s), 1.59 (3H, s), 1.85 (3H, s), 1.85-1.95 (2H, m), 1.99 (3H, s), 2.02 (3H, s), 2.1-2.2 (5H, m), 2.6 (2H, t, J=7.4Hz), 2.8-2.95 (1H, m), 3.59 (1H, d, J=16.1Hz), 3.68 (1H, d, J=16.1Hz), 4.0-4.1 (1H, m), 4.14 (1H, dd, J=11.0Hz, 8.2Hz), 4.27 (1H, dd, J=11.0Hz, 5.6Hz), 5.08 (1H, dd, J=10.3Hz, 3.5Hz), 5.37 (1H, d, J=8.1Hz), 5.4-5.5 (2H, m), 6.19 (1H, s), 6.95-7.1 (4H, m)

Reference Example 20

3-(2,3,4,6-Tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-{3-[1-carboxy-1-(methyl)ethylcarbamoyl]propyl}phenyl)methyl]-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Reference Example 19 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-({4-[(1*E*)-3-carboxyprop-1-enyl]phenyl}methyl)-5-isopropyl-1*H*-pyrazole instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-galactopyranosyloxy)-4-({4-[(1*E*)-3-carboxyprop-1-enyl]phenyl}methyl)-5-isopropyl-1*H*-pyrazole.

^{1}H—NMR ($CDCl_3$) δ ppm:

1.05-1.2 (6H, m), 1.57 (3H, s), 1.58 (3H, s), 1.85 (3H, s), 1.85-1.95 (2H, m), 2.0 (3H, s), 2.03 (3H, s), 2.05 (3H, s), 2.15 (2H, t, J=7.6Hz), 2.6 (2H, t, J=7.5Hz), 2.8-2.95 (1H, m), 3.58 (1H, d, J=15.7Hz), 3.66 (1H, d, J=15.7Hz), 3.8-3.9 (1H, m), 4,17 (1H, dd, J=11.9Hz, 2.2Hz), 4.34 (1H, dd, J=11.9Hz, 3.4Hz), 5.15-5.3 (3H, m), 5.35-5.45 (1H, m), 6.18 (1H, s), 6.95-7.1 (4H, m)

Reference Example 21

3-(2,3,4,6-Tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-{3-[1-carboxy-1-(methyl)ethylcarbamoyl]propyl}-2-methylphenyl)methyl]-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Reference Example 19 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-({4-[(1*E*)-3-carboxyprop-1-enyl]-2-methylphenyl}methyl)-5-isopropyl-1*H*-pyrazole instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-galactopyranosyloxy)-4-({4-[(1*E*)-3-carboxyprop-1-enyl]phenyl}methyl)-5-isopropyl-1*H*-pyrazole.

^{1}H−NMR ($CDCl_3$) δ ppm:
1.05-1.15 (6H, m), 1.57 (3H, s), 1.58 (3H, s), 1.76 (3H, s), 1.85-1.95 (2H, m), 1.99 (3H, s), 2.02 (3H, s), 2.05 (3H, s), 2.1-2.2 (2H, m), 2.25 (3H, s), 2.5-2.6 (2H, m), 2.7-2.85 (1H, m), 3.51 (1H, d, J=16.8Hz), 3.61 (1H, d, J=16.8Hz), 3.8-3.9 (1H, m), 4.1-4.2 (1H, m), 4.32 (1H, dd, J=12.2Hz, 3.4Hz), 5.15-5.3 (3H, m), 5.38 (1H, d, J=8.1Hz), 6.23 (1H, s), 6.77 (1H, d, J=7.8Hz), 6.85 (1H, d, J=7.8Hz), 6.93 (1H, s)

Example 48

3-(β-D-Galactopyranosyloxy)-4-[(4-{3-[1-{[4-(2-hydroxyethyl)piperazin-1-yl]carbonyl}-1-(methyl)ethylcarbamoyl]propyl}phenyl)methyl]-5-isopropyl-1*H*-pyrazole

To a solution of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-galactopyranosyloxy)-4-[(4-{3-[1-carboxy-1-(methyl)ethyl-

carbamoyl]propyl}phenyl)methyl]-5-isopropyl-1*H*-pyrazole (30 mg) in *N*,*N*-dimethylformamide (0.5 mL) were added 1-ethyl-3-(3-dimethylaminopropyl)carbodiimide hydrochloride (12 mg), 1-hydroxybenzotriazole (9 mg) and 1-(2-hydroxyethyl)piperazine (54 mg), and the mixture was stirred at room temperature overnight. To the reaction mixture was added 5 mol/L aqueous sodium hydroxide solution (0.25 mL), and the resulting mixture was stirred at room temperature for 1 hour. To the reaction mixture was added acetic acid (0.1 mL), and the mixture was diluted with water (1 mL). The insoluble material was removed by filtration, and the filtrate was purified by preparative reverse phase column chromatography (Shiseido CAPCELL PAK UG120 ODS, 5 μL, 120 Å, 20 x 50mm, flow rate 30 mL/minute linear gradient, water/acetonitrile = 90/10 - 10/60) to give the title compound (4 mg).

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.15 (6H, m), 1.42 (6H, s), 1.8-1.95 (2H, m), 2.17 (2H, t, J=7.7Hz), 2.35-2.55 (6H, m), 2.58 (2H, t, J=7.6Hz), 2.8-2.95 (1H, m), 3.52 (1H, dd, J=9.7Hz, 3.4Hz), 3.55-3.8 (12H, m), 3.87 (1H, d, J=3.4Hz), 5.08 (1H, d, J=8.0Hz), 7.0-7.15 (4H, m)

Example 49

3-(β-D-Glucopyranosyloxy)-4-{[4-(3-{1-[2-hydroxy-1-(hydroxymethyl)ethylcarbamoyl]-1-(methyl)ethylcarbamoyl}-propyl)phenyl]methyl}-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 48 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-{3-[1-carboxy-1-(methyl)ethyl-

carbamoyl]propyl}phenyl)methyl]-5-isopropyl-1*H*-pyrazole and 2-amino-1,3-propanediol instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-galactopyranosyloxy)-4-[(4-{3-[1-carboxy-1-(methyl)-ethylcarbamoyl]propyl}phenyl)methyl]-5-isopropyl-1*H*-pyrazole and 1-(2-hydroxyethyl)piperazine, respectively.

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.2 (6H, m), 1.43 (6H, s), 1.8-1.95 (2H, m), 2.19 (2H, t, J=7.5Hz), 2.58 (2H, t, J=7.5Hz), 2.85-2.95 (1H, m), 3.25-3.45 (4H, m), 3.5-3.95 (9H, m), 5.0-5.15 (1H, m), 7.0-7.2 (4H, m)

Example 50

3-(β-D-Glucopyranosyloxy)-4-{[4-(3-{1-[2-hydroxy-1,1-bis-(hydroxymethyl)ethylcarbamoyl]-1-(methyl)ethylcarbamoyl}-propyl)phenyl]methyl}-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 48 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-{3-[1-carboxy-1-(methyl)ethyl-carbamoyl]propyl}phenyl)methyl]-5-isopropyl-1*H*-pyrazole and tris(hydroxymethyl)aminomethane instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-galactopyranosyloxy)-4-[(4-{3-[1-carboxy-1-(methyl)ethylcarbamoyl]propyl}phenyl)methyl]-5-isopropyl-1*H*-pyrazole and 1-(2-hydroxyethyl)piperazine, respectively.

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.2 (6H, m), 1.42 (6H, s), 1.8-1.95 (2H, m), 2.18 (2H, t, J=7.5Hz), 2.58 (2H, t, J=7.5Hz), 2.85-3.0 (1H, m), 3.25-3.45 (4H, m), 3.6-3.9 (10H, m), 5.0-5.15 (1H, m), 7.0-7.2 (4H, m)

Example 51

3-(β-D-Galactopyranosyloxy)-4-[(4-{3-[1-(2-hydroxyethyl-carbamoyl)-1-(methyl)ethylcarbamoyl]propyl}phenyl)methyl]-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 48 using 2-aminoethanol instead of 1-(2-hydroxyethyl)piperazine.

^{1}H—NMR (CD_3OD) δ ppm:

1.1-1.15 (6H, m), 1.42 (6H, s), 1.8-1.9 (2H, m), 2.19 (2H, t, J=7.6Hz), 2.57 (2H, t, J=7.6Hz), 2.8-2.95 (1H, m), 3.28 (2H, t, J=5.8Hz), 3.45-3.65 (4H, m), 3.65-3.8 (5H, m), 3.86 (1H, d, J=2.7Hz), 5.08 (1H, d, J=7.9Hz), 7.0-7.15 (4H, m)

Example 52

3-(β-D-Galactopyranosyloxy)-5-isopropyl-4-{[4-(3-{1-[2-(dimethylamino)ethylcarbamoyl]-1-(methyl)ethylcarbamoyl}-propyl)phenyl]methyl}-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 48 using *N*,*N*-dimethylethylenediamine instead of 1-(2-hydroxyethyl)piperazine.

^{1}H—NMR (CD_3OD) δ ppm:

1.1-1.15 (6H, m), 1.41 (6H, s), 1.8-1.9 (2H, m), 2.19 (2H, t, J=7.7Hz), 2.24 (6H, s), 2.42 (2H, t, J=6.8Hz), 2.58 (2H, t, J=7.6Hz), 2.8-2.95 (1H, m), 3.28 (2H, t, J=6.8Hz), 3.52 (1H, dd, J=9.7Hz, 3.3Hz), 3.55-3.65 (1H, m), 3.65-3.8 (5H, m), 3.8-3.9 (1H, m), 5.08 (1H, d, J=7.4Hz), 7.0-7.15 (4H, m)

Example 53

3-(β-D-Glucopyranosyloxy)-5-isopropyl-4-{[4-(3-{1-[2-(dimethylamino)ethylcarbamoyl]-1-(methyl)ethylcarbamoyl}-propyl)phenyl]methyl}-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 48 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-{3-[1-carboxy-1-(methyl)ethyl-carbamoyl]propyl}phenyl)methyl]-5-isopropyl-1*H*-pyrazole and *N*,*N*-dimethylethylenediamine instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-galactopyranosyloxy)-4-[(4-{3-[1-carboxy-1-(methyl)ethylcarbamoyl]propyl}phenyl)methyl]-5-isopropyl-1*H*-pyrazole and 1-(2-hydroxyethyl)piperazine, respectively.
^{1}H−NMR (CD_3OD) δ ppm:
1.05-1.15 (6H, m), 1.41 (6H, s), 1.8-1.9 (2H, m), 2.18 (2H, t, J=7.5Hz), 2.23 (6H, s), 2.41 (2H, t, J=6.8Hz), 2.57 (2H, t, J=7.6Hz), 2.8-2.95 (1H, m), 3.2-3.45 (6H, m), 3.6-3.9 (4H, m), 5.0-5.1 (1H, m), 7.0-7.15 (4H, m)

Example 54

3-(β-D-Glucopyranosyloxy)-5-isopropyl-4-{[4-(3-{1-[3-(dimethylamino)propylcarbamoyl]-1-(methyl)ethylcarbamoyl}-propyl)phenyl]methyl}-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 48 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-{3-[1-carboxy-1-(methyl)ethyl-carbamoyl]propyl}phenyl)methyl]-5-isopropyl-1*H*-pyrazole and *N*,*N*-dimethyl-1,3-propanediamine instead of 3-(2,3,4,6-tetra-

O-acetyl-β-D-galactopyranosyloxy)-4-[(4-{3-[1-carboxy-1-(methyl)ethylcarbamoyl]propyl}phenyl)methyl]-5-isopropyl-1*H*-pyrazole and 1-(2-hydroxyethyl)piperazine, respectively.

^{1}H−NMR (CD_3OD) δ ppm:

1.1-1.15 (6H, m), 1.41 (6H, s), 1.6-1.7 (2H, m), 1.8-1.9 (2H, m), 2.19 (2H, t, J=7.7Hz), 2.22 (6H, s), 2.35 (2H, t, J=7.6Hz), 2.57 (2H, t, J=7.6Hz), 2.85-2.95 (1H, m), 3.18 (2H, t, J=6.6Hz), 3.3-3.45 (4H, m), 3.6-3.8 (3H, m), 3.8-3.9 (1H, m), 5.0-5.1 (1H, m), 7.0-7.15 (4H, m)

Example 55

3-(β-D-Glucopyranosyloxy)-4-[(4-{3-[1-{[4-(2-hydroxyethyl)-piperazin-1-yl]carbonyl}-1-(methyl)ethylcarbamoyl]propyl}-phenyl)methyl]-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 48 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-{3-[1-carboxy-1-(methyl)ethyl-carbamoyl]propyl}phenyl)methyl]-5-isopropyl-1*H*-pyrazole instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-galactopyranosyl-oxy)-4-[(4-{3-[1-carboxy-1-(methyl)ethylcarbamoyl]propyl}-phenyl)methyl]-5-isopropyl-1*H*-pyrazole.

^{1}H−NMR (CD_3OD) δ ppm:

1.1-1.2 (6H, m), 1.42 (6H, s), 1.8-1.95 (2H, m), 2.16 (2H, t, J=7.5Hz), 2.35-2.55 (6H, m), 2.58 (2H, t, J=7.3Hz), 2.85-3.0 (1H, m), 3.25-3.45 (4H, m), 3.55-3.9 (10H, m), 5.0-5.15 (1H, m), 7.0-7.15 (4H, m)

Example 56

4-[(4-{3-[1-(2-Aminoethylcarbamoyl)-1-(methyl)ethyl-carbamoyl]propyl}phenyl)methyl]-3-(β-D-galactopyranosyl-oxy)-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 48 using ethylenediamine instead of 1-(2-hydroxyethyl)piperazine.

^{1}H−NMR (CD_3OD) δ ppm:

1.1-1.2 (6H, m), 1.41 (6H, s), 1.8-1.9 (2H, m), 2.19 (2H, t, J=7.5Hz), 2.58 (2H, t, J=7.6Hz), 2.7 (2H, t, J=5.9Hz), 2.85-2.95 (1H, m), 3.24 (2H, t, J=5.9Hz), 3.51 (1H, dd, J=9.8Hz, 3.2Hz), 3.55-3.65 (1H, m), 3.65-3.8 (5H, m), 3.86 (1H, d, J=3.2Hz), 5.07 (1H, d, J=7.9Hz), 7.0-7.15 (4H, m)

Example 57

3-(β-D-Galactopyranosyloxy)-5-isopropyl-4-{[4-(3-{1-[(piperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}-propyl)phenyl]methyl}-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 48 using piperazine instead of 1-(2-hydroxyethyl)piperazine.

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.2 (6H, m), 1.42 (6H, s), 1.8-1.95 (2H, m), 2.1-2.2 (2H, m), 2.58 (2H, t, J=7.4Hz), 2.65-2.8 (4H, m), 2.85-2.95 (1H, m), 3.45-3.8 (11H, m), 3.8-3.9 (1H, m), 5.08 (1H, d, J=8.0Hz), 7.0-7.15 (4H, m)

Example 58

3-(β-D-Glucopyranosyloxy)-5-isopropyl-4-{[4-(3-{1-[(piperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}-propyl)phenyl]methyl}-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 48 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-{3-[1-carboxy-1-(methyl)ethyl-carbamoyl]propyl}phenyl)methyl]-5-isopropyl-1*H*-pyrazole and piperazine instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-galactopyranosyloxy)-4-[(4-{3-[1-carboxy-1-(methyl)ethyl-carbamoyl]propyl}phenyl)methyl]-5-isopropyl-1*H*-pyrazole and 1-(2-hydroxyethyl)piperazine, respectively.

^{1}H−NMR (CD_3OD) δ ppm:
1.1-1.2 (6H, m), 1.42 (6H, s), 1.8-1.95 (2H, m), 2.17 (2H, t, J=7.6Hz), 2.5-2.85 (6H, m), 2.85-3.0 (1H, m), 3.25-3.45 (4H, m), 3.5-3.9 (8H, m), 5.0-5.15 (1H, m), 7.0-7.15 (4H, m)

Example 59

3-(β-D-Glucopyranosyloxy)-4-[(4-{3-[1-{[4-(2-hydroxyethyl)-piperazin-1-yl]carbonyl}-1-(methyl)ethylcarbamoyl]propyl}-2-methylphenyl)methyl]-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 48 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-{3-[1-carboxy-1-(methyl)ethyl-carbamoyl]propyl}-2-methylphenyl)methyl]-5-isopropyl-1*H*-pyrazole instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-galacto-pyranosyloxy)-4-[(4-{3-[1-carboxy-1-(methyl)ethyl-

carbamoyl]propyl}phenyl)methyl]-5-isopropyl-1*H*-pyrazole.

^{1}H—NMR (CD_3OD) δ ppm:

1.05-1.15 (6H, m), 1.42 (6H, s), 1.8-1.9 (2H, m), 2.1-2.2 (2H, m), 2.3 (3H, s), 2.35-2.6 (8H, m), 2.75-2.9 (1H, m), 3.25-3.4 (4H, m), 3.45-3.75 (9H, m), 3.8 (1H, d, J=11.1Hz), 4.95-5.05 (1H, m), 6.8-7.0 (3H, m)

Example 60

3-(β-D-Galactopyranosyloxy)-4-{[4-(3-{1-[2-hydroxy-1,1-bis-(hydroxymethyl)ethylcarbamoyl]-1-(methyl)ethylcarbamoyl}-propyl)phenyl]methyl}-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 48 using tris(hydroxymethyl)-aminomethane instead of 1-(2-hydroxyethyl)piperazine.

^{1}H—NMR (CD_3OD) δ ppm:

1.05-1.2 (6H, m), 1.42 (6H, s), 1.8-1.95 (2H, m), 2.18 (2H, t, J=7.5Hz), 2.58 (2H, t, J=7.6Hz), 2.8-2.95 (1H, m), 3.52 (1H, dd, J=9.7Hz, 3.4Hz), 3.55-3.9 (13H, m), 5.07 (1H, d, J=7.5Hz), 7.0-7.15 (4H, m)

Example 61

3-(β-D-Galactopyranosyloxy)-5-isopropyl-4-{[4-(3-{1-[(4-methylpiperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}-propyl)phenyl]methyl}-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 48 using 1-methylpiperazine instead of 1-(2-hydroxyethyl)piperazine.

^{1}H—NMR (CD_3OD) δ ppm:

1.1-1.15 (6H, m), 1.42 (6H, s), 1.8-1.9 (2H, m), 2.1-2.2 (2H, m), 2.25 (3H, s), 2.3-2.45 (4H, m), 2.58 (2H, t, J=7.4Hz), 2.85-2.95 (1H, m), 3.52 (1H, dd, J=9.6Hz, 3.2Hz), 3.55-3.8 (10H, m), 3.8-3.9 (1H, m), 5.08 (1H, d, J=7.4Hz), 7.0-7.15 (4H, m)

Example 62

3-(β-D-Galactopyranosyloxy)-5-isopropyl-4-{[4-(3-{1-[(4-isopropylpiperazin-1-yl)carbonyl]-1-(methyl)ethyl-carbamoyl}propyl)phenyl]methyl}-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 48 using 1-isopropylpiperazine instead of 1-(2-hydroxyethyl)piperazine.

^{1}H—NMR (CD_3OD) δ ppm:

1.03 (6H, d, J=6.6Hz), 1.05-1.15 (6H, m), 1.42 (6H, s), 1.8-1.95 (2H, m), 2.1-2.2 (2H, m), 2.35-2.7 (7H, m), 2.8-2.95 (1H, m), 3.52 (1H, dd, J=9.8Hz, 3.4Hz), 3.55-3.8 (10H, m), 3.8-3.9 (1H, m), 5.08 (1H, d, J=7.8Hz), 7.0-7.15 (4H, m)

Example 63

3-(β-D-Glucopyranosyloxy)-5-isopropyl-4-({4-[(1*E*)-2-{1-[2-(dimethylamino)ethylcarbamoyl]-1-(methyl)ethylcarbamoyl}-vinyl]phenyl}methyl)-1*H*-pyrazole

To a solution of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-gluco-pyranosyloxy)-4-({4-[(1*E*)-2-carboxyvinyl]phenyl}methyl)-5-isopropyl-1*H*-pyrazole (1.2 g) in *N*,*N*-dimethylformamide (15 mL) and dichloromethane (10 mL) was added triethylamine (15 mL).

To the mixture were added 1-ethyl-3-(3-dimethylamino-propyl)carbodiimide hydrochloride (0.56 g), 1-hydroxy-benzotriazole (0.4 g), and a solution of 2-amino-2-methyl-propionic acid (2.0 g) in water (15 mL), and the mixture was stirred at room temperature overnight. The reaction mixture was neutralized by addition of 2 mol/L aqueous acetic acid solution, and the mixture was extracted with ethyl acetate. The organic layer was washed with water and brine successively, and dried over anhydrous sodium sulfate. The solvent was removed under reduced pressure, and the residue was purified by column chromatography on silica gel (eluent: ethyl acetate - dichloromethane/methanol = 7/1 - 3/1) to give 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-{(1*E*)-2-[1-carb oxy-1-(methyl)ethylcarbamoyl]vinyl}phenyl)methyl]-5-isopropyl-1*H*-pyrazole (0.44 g). This material was dissolved in *N*,*N*-dimethylformamide (0.3 mL). To the solution were added 1-ethyl-3-(3-dimethylaminopropyl)carbodiimide hydrochloride (0.18 g), 1-hydroxybenzotriazole (0.13 g) and *N*,*N*-dimethyl-ethylenediamine (0.55 g), and the mixture was stirred at room temperature overnight. To the reaction mixture was added 5 mol/L aqueous sodium hydroxide solution (1.5 mL), and the mixture was stirred at room temperature for 1 hour. To the reaction mixture was added acetic acid (1 mL), and the mixture was diluted with water (3 mL). The insoluble material was removed by filtration, and the filtrate was purified by preparative reverse phase column chromatography (Shiseido CAPCELL PAK UG120 ODS, 5 μL, 120 Å, 20 x 50 mm, flow rate 30 mL/minute linear gradient, water/

acetonitrile = 90/10 - 10/60) to give the title compound (71 mg).

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.15 (6H, m), 1.49 (6H, s), 2.27 (6H, s), 2.46 (2H, t, J=6.7Hz), 2.8-2.95 (1H, m), 3.25-3.45 (6H, m), 3.6-3.9 (4H, m), 5.05-5.15 (1H, m), 6.61 (1H, d, J=15.7Hz), 7.2-7.3 (2H, m), 7.35-7.5 (3H, m)

Example 64

3-(β-D-Glucopyranosyloxy)-5-isopropyl-4-({4-[(1*E*)-2-{1-[(piperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}vinyl]-phenyl}methyl)-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 63 using piperazine instead of *N*,*N*-dimethylethylenediamine.

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.15 (6H, m), 1.51 (6H, s), 2.65-2.8 (4H, m), 2.85-2.95 (1H, m), 3.25-3.45 (4H, m), 3.5-3.9 (8H, m), 5.05-5.15 (1H, m), 6.55 (1H, d, J=15.8Hz), 7.2-7.3 (2H, m), 7.4-7.55 (3H, m)

Example 65

3-(β-D-Glucopyranosyloxy)-4-[(4-{(1*E*)-2-[1-{[4-(2-hydroxy-ethyl)piperazin-1-yl]carbonyl}-1-(methyl)ethylcarbamoyl]-vinyl}phenyl)methyl]-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 63 using 1-(2-hydroxyethyl)piperazine instead of *N*,*N*-dimethylethylenediamine.

^{1}H—NMR (CD_3OD) δ ppm:

1.1-1.2 (6H, m), 1.51 (6H, s), 2.35-2.65 (6H, m), 2.85-2.95 (1H, m), 3.25-3.45 (4H, m), 3.55-3.9 (10H, m), 5.05-5.15 (1H, m), 6.55 (1H, d, J=15.8Hz), 7.2-7.3 (2H, m), 7.4-7.5 (3H, m)

Example 66

3-(β-D-Glucopyranosyloxy)-4-[(4-{3-[(*S*)-2-hydroxy-1-(methyl)ethylcarbamoyl]propyl}phenyl)methyl]-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 1 using (*S*)-2-amino-1-propanol instead of glycinamide hydrochloride.

^{1}H—NMR (CD_3OD) δ ppm:

1.05-1.2 (9H, m), 1.8-1.95 (2H, m), 2.17 (2H, t, J=7.7Hz), 2.57 (2H, t, J=7.6Hz), 2.8-2.95 (1H, m), 3.25-3.5 (6H, m), 3.6-3.8 (3H, m), 3.83 (1H, d, J=11.9Hz), 3.85-4.0 (1H, m), 5.0-5.1 (1H, m), 7.0-7.15 (4H, m)

Example 67

3-(β-D-Galactopyranosyloxy)-4-[(4-{3-[(*S*)-2-hydroxy-1-(methyl)ethylcarbamoyl]propyl}phenyl)methyl]-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 1 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-galactopyranosyloxy)-4-({4-[(1*E*)-3-carboxyprop-1-enyl]-phenyl}methyl)-5-isopropyl-1*H*-pyrazole and (*S*)-2-amino-1-propanol instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-gluco-

pyranosyloxy)-4-({4-[(1*E*)-3-carboxyprop-1-enyl]phenyl}-methyl)-5-isopropyl-1*H*-pyrazole and glycinamide hydrochloride, respectively.

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.2 (9H, m), 1.8-1.95 (2H, m), 2.17 (2H, t, J=7.6Hz), 2.57 (2H, t, J=7.6Hz), 2.85-2.95 (1H, m), 3.35-3.55 (3H, m), 3.55-3.65 (1H, m), 3.65-4.0 (7H, m), 5.0-5.15 (1H, m), 7.0-7.15 (4H, m)

Example 68

3-(β-D-Galactopyranosyloxy)-4-[(4-{3-[2-hydroxy-1,1-di-(methyl)ethylcarbamoyl]propyl}phenyl)methyl]-5-isoproypl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 1 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-galactopyranosyloxy)-4-({4-[(1*E*)-3-carboxyprop-1-enyl]-phenyl}methyl)-5-isopropyl-1*H*-pyrazole and 2-amino-2-methyl-1-propanol instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-({4-[(1*E*)-3-carboxyprop-1-enyl]-phenyl}methyl)-5-isopropyl-1*H*-pyrazole and glycinamide hydrochloride, respectively.

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.15 (6H, m), 1.25 (6H, s), 1.8-1.9 (2H, m), 2.15 (2H, t, J=7.6Hz), 2.56 (2H, t, J=7.5Hz), 2.8-2.95 (1H, m), 3.45-3.65 (4H, m), 3.65-3.8 (5H, m), 3.8-3.9 (1H, m), 5.0-5.1 (1H, m), 7.0-7.15 (4H, m)

Example 69

4-[(4-{3-[(*S*)-5-Amino-5-(carbamoyl)pentylcarbamoyl]propyl}-phenyl)methyl]-3-(β-D-galactopyranosyloxy)-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 1 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-galactopyranosyloxy)-4-({4-[(1*E*)-3-carboxyprop-1-enyl]-phenyl}methyl)-5-isopropyl-1*H*-pyrazole and (*S*)-2-benzyloxy-carbonylamino-6-aminohexanamide hydrochloride instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-({4-[(1*E*)-3-carboxyprop-1-enyl]phenyl}methyl)-5-isopropyl-1*H*-pyrazole and glycinamide hydrochloride, respectively.

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.15 (6H, m), 1.3-1.6 (5H, m), 1.6-1.75 (1H, m), 1.8-1.9 (2H, m), 2.15 (2H, t, J=7.7Hz), 2.56 (2H, t, J=7.3Hz), 2.8-2.95 (1H, m), 3.15 (2H, t, J=7.0Hz), 3.28 (1H, t, J=6.4Hz), 3.52 (1H, dd, J=9.8Hz, 3.1Hz), 3.55-3.65 (1H, m), 3.65-3.8 (5H, m), 3.8-3.9 (1H, m), 5.08 (1H, d, J=7.9Hz), 7.0-7.15 (4H, m)

Example 70

4-[(4-{3-[(*S*)-2-Amino-1-(methyl)ethylcarbamoyl]propyl}-phenyl)methyl]-3-(β-D-glucopyranosyloxy)-5-isopropyl-1*H*-pyrazole

To a solution of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-gluco-pyranosyloxy)-4-({4-[(1*E*)-3-carboxyprop-1-enyl]phenyl}-methyl)-5-isopropyl-1*H*-pyrazole (1.6 g) in methanol (20 mL) was added 10% palladium-carbon powder, and the mixture was stirred at room temperature under a hydrogen atmosphere for 3 hours.

The insoluble material was removed by filtration, and the filtrate was concentrated under reduced pressure to give 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-{[4-(3-carboxypropyl)phenyl]methyl}-5-isopropyl-1*H*-pyrazole (1.5 g). This material was dissolved in *N*,*N*-dimethylformamide (15 mL). To the solution were added (*S*)-2-amino-1-propanol (0.89 g), 1-hydroxybenzotriazole (0.48 g) and 1-ethyl-3-(3-dimethylaminopropyl)carbodiimide hydrochloride (0.68 g), and the mixture was stirred at room temperature overnight. The reaction mixture was poured into water, and the resulting mixture was extracted with dichloromethane twice. The extracts were washed with water and brine, and dried over anhydrous sodium sulfate. The solvent was removed under reduced pressure to give 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-{3-[(*S*)-2-hydroxy-1-(methyl)ethylcarbamoyl]propyl}phenyl)-methyl]-5-isopropyl-1*H*-pyrazole (1.64 g). The obtained 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-{3-[(*S*)-2-hydroxy-1-(methyl)ethylcarbamoyl]propyl}phenyl)-methyl]-5-isopropyl-1*H*-pyrazole (0.19 g) was dissolved in dichloromethane (2 mL). To the solution were added triethylamine (0.058 mL) and methanesulfonyl chloride (0.032 mL) under ice-cooling, and the mixture was stirred at room temperature for 1 hour. The reaction mixture was poured into water, and the resulting mixture was extracted with dichloromethane twice. The extracts were washed with water and brine, and dried over anhydrous sodium sulfate. The solvent was removed under reduced pressure. The residue was dissolved in *N*,*N*-dimethylformamide

(1 mL). To the solution was added sodium azide (0.18 g), and the mixture was stirred at 100°C overnight. The reaction mixture was cooled to room temperature. Five mol/L aqueous sodium hydroxide solution (1.5 mL) was added to the mixture, and the mixture was stirred for 1 hour. Acetic acid (1 mL) and water (2 mL) were added to the reaction mixture. The insoluble material was removed by filtration, and the filtrate was purified by preparative reverse phase column chromatography (Shiseido CAPCELL PAK UG120 ODS, 5 μm, 120 Å, 20 x 50 mm, flow rate 30 mL/minute linear gradient, water/acetonitrile = 90/10 - 10/90) to give 4-[(4-{3-[(1*S*)-2-azido-1-(methyl)ethylcarbamoyl]-propyl}phenyl)methyl]-3-(β-D-glucopyranosyloxy)-5-isopropyl-1*H*-pyrazole (18 mg). This material was dissolved in methanol (1 mL). To the solution was added 10% palladium-carbon powder (0.01 g), and the mixture was stirred at room temperature under a hydrogen atmosphere for 4 hours. The insoluble material was removed by filtration, and the filtrate was concentrated under reduced pressure to give the title compound (12 mg).

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.2 (9H, m), 1.8-1.95 (2H, m), 2.1-2.25 (2H, m), 2.5-2.65 (4H, m), 2.8-2.95 (1H, m), 3.25-3.45 (4H, m), 3.6-3.9 (5H, m), 5.0-5.1 (1H, m), 7.0-7.15 (4H, m)

Example 71

4-[(4-{3-[2-Amino-1,1-di(methyl)ethylcarbamoyl]propyl}-phenyl)methyl]-3-(β-D-galactopyranosyloxy)-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 1 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-galactopyranosyloxy)-4-({4-[(1*E*)-3-carboxyprop-1-enyl]-phenyl}methyl)-5-isopropyl-1*H*-pyrazole and 2-amino-1-benzyloxycarbonylamino-2-(methyl)propane instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-({4-[(1*E*)-3-carboxyprop-1-enyl]phenyl}methyl)-5-isopropyl-1*H*-pyrazole and glycinamide hydrochloride, respectively.

^{1}H—NMR (CD_3OD) δ ppm:

1.05-1.15 (6H, m), 1.27 (6H, s), 1.8-1.9 (2H, m), 2.16 (2H, t, J=7.7Hz), 2.57 (2H, t, J=7.6Hz), 2.8-2.95 (3H, m), 3.51 (1H, dd, J=9.8Hz, 3.7Hz), 3.55-3.65 (1H, m), 3.65-3.8 (5H, m), 3.8-3.9 (1H, m), 5.08 (1H, d, J=7.7Hz), 7.0-7.15 (4H, m)

Example 72

4-[(4-{3-[(*R*)-5-Amino-1-(hydroxymethyl)pentylcarbamoyl]-propyl}phenyl)methyl]-3-(β-D-galactopyranosyloxy)-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 1 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-galactopyranosyloxy)-4-({4-[(1*E*)-3-carboxyprop-1-enyl]-phenyl}methyl)-5-isopropyl-1*H*-pyrazole and (*R*)-2-amino-6-benzyloxycarbonylamino-1-hexanol instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-({4-[(1*E*)-3-carboxyprop-1-enyl]phenyl}methyl)-5-isopropyl-1*H*-pyrazole and glycinamide hydrochloride, respectively.

^{1}H—NMR (CD_3OD) δ ppm:

1.05-1.2 (6H, m), 1.2-1.7 (6H, m), 1.8-1.95 (2H, m), 2.2 (2H, t, J=7.5Hz), 2.57 (2H, t, J=7.6Hz), 2.65 (2H, t, J=7.3z), 2.8-3.0 (1H, m), 3.4-3.65 (4H, m), 3.65-3.95 (7H, m), 5.0-5.15 (1H, m), 7.0-7.15 (4H, m)

Example 73

3-(β-D-Glucopyranosyloxy)-4-[(4-{(1*E*)-3-[(*S*)-2-hydroxy-1-(methyl)ethylcarbamoyl]prop-1-enyl}phenyl)methyl]-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 26 using (*S*)-2-amino-1-propanol instead of ammonium chloride.

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.2 (9H, m), 2.8-2.95 (1H, m), 3.09 (2H, d, J=7.4Hz), 3.25-3.55 (6H, m), 3.6-3.9 (4H, m), 3.9-4.0 (1H, m), 5.05-5.15 (1H, m), 6.2-6.3 (1H, m), 6.47 (1H, d, J=15.9Hz), 7.1-7.2 (2H, m), 7.2-7.3 (2H, m)

Example 74

3-(β-D-Glucopyranosyloxy)-4-{[4-(3-{(*S*)-1-[2-hydroxy-1-(hydroxymethyl)ethylcarbamoyl]ethylcarbamoyl}propyl)-phenyl]methyl}-5-isopropyl-1*H*-pyrazole

To a solution of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-gluco-pyranosyloxy)-4-({4-[(1*E*)-3-carboxyprop-1-enyl]phenyl}-methyl)-5-isopropyl-1*H*-pyrazole (7.13 g) in *N*,*N*-dimethyl-formamide (30 mL) were added 1-hydroxybenzotriazole (2.31 g), 1-ethyl-3-(3-dimethylaminopropyl)carbodiimide hydrochloride

(3.25 g) and benzyl (*S*)-2-aminopropionate (8.34 g), and the mixture was stirred at room temperature overnight. The reaction mixture was poured into water, and the resulting mixture was extracted with ethyl acetate twice. The extracts were washed with water and brine successively, and dried over sodium sulfate. The solvent was removed under reduced pressure, and the residue was purified by column chromatography on silica gel (eluent: *n*-hexane/ethyl acetate = 1/2) to give 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-{(1*E*)-3-[(*S*)-1-(benzyloxycarbonyl)ethylcarbamoyl]prop-1-enyl}phenyl)-methyl]-5-isopropyl-1*H*-pyrazole (3.25 g). This material was dissolved in methanol (40 mL). To the solution was added 10% palladium-carbon powder (1.0 g), and the mixture was stirred at room temperature under a hydrogen atmosphere overnight. The insoluble material was removed by filtration, and the filtrate was concentrated under reduced pressure to give 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-{3-[(*S*)-1-(carboxy)ethylcarbamoyl]propyl}phenyl)methyl]-5-isopropyl-1*H*-pyrazole (2.25 g). To a solution of the obtained 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-{3-[(*S*)-1-(carboxy)ethylcarbamoyl]propyl}phenyl)methyl]-5-isopropyl-1*H*-pyrazole (0.09 g) in *N*,*N*-dimethylformamide (0.5 mL) were added 1-hydroxybenzotriazole (0.026 g), 1-ethyl-3-(3-dimethylaminopropyl)carbodiimide hydrochloride (0.037 g) and 2-amino-1,3-propanediol (0.12 g), and the mixture was stirred at room temperature for 1 hour. To the reaction mixture was added 5 mol/L aqueous sodium hydroxide solution (0.5 mL), and

the mixture was stirred at room temperature for 1 hour. Acetic acid (0.3 mL) and water (1 mL) were added to the reaction mixture. The insoluble material was removed by filtration, and the filtrate was purified by preparative reverse phase column chromatography (Shiseido CAPCELL PAK™ UG120 ODS, 5 μL, 120 Å, 20 x 50 mm, flow rate 30 mL/minute linear gradient, water/acetonitrile = 90/10 - 10/90) to give the title compound (0.017 g).

^{1}H—NMR (CD_3OD) δ ppm:

1.1-1.2 (6H, m), 1.32 (3H, d, J=6.8Hz), 1.8-1.95 (2H, m), 2.15-2.3 (2H, m), 2.58 (2H, t, J=7.5Hz), 2.85-2.95 (1H, m), 3.25-3.45 (4H, m), 3.5-3.95 (9H, m), 4.25-4.35 (1H, m), 5.0-5.1 (1H, m), 7.0-7.15 (4H, m)

Example 75

3-(β-D-Glucopyranosyloxy)-4-[(4-{3-[(*S*)-1-(2-hydroxyethylcarbamoyl)ethylcarbamoyl]propyl}phenyl)methyl]-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 74 using 2-aminoethanol instead of 2-amino-1,3-propanediol.

^{1}H—NMR (CD_3OD) δ ppm:

1.1-1.15 (6H, m), 1.31 (3H, d, J=7.0Hz), 1.8-1.95 (2H, m), 2.15-2.25 (2H, m), 2.58 (2H, t, J=7.6Hz), 2.85-2.95 (1H, m), 3.25-3.45 (6H, m), 3.58 (2H, t, J=5.7Hz), 3.6-3.8 (3H, m), 3.83 (1H, d, J=11.9Hz), 4.25-4.35 (1H, m), 5.0-5.1 (1H, m), 7.0-7.15 (4H, m)

Example 76

3-(β-D-Glucopyranosyloxy)-5-isopropyl-4-{[4-(3-{(*S*)-1-[(4-methylpiperazin-1-yl)carbonyl]ethylcarbamoyl}propyl)-phenyl]methyl}-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 74 using 1-methylpiperazine instead of 2-amino-1,3-propanediol.

^{1}H—NMR (CD_3OD) δ ppm:

1.05-1.2 (6H, m), 1.26 (3H, d, J=7.0Hz), 1.8-1.95 (2H, m), 2.2 (2H, t, J=7.4Hz), 2.25-2.55 (7H, m), 2.57 (2H, t, J=7.6Hz), 2.8-2.95 (1H, m), 3.25-3.45 (4H, m), 3.45-3.75 (6H, m), 3.77 (1H, d, J=16.0Hz), 3.83 (1H, d, J=11.7Hz), 4.75-4.9 (1H, m), 5.0-5.1 (1H, m), 7.0-7.15 (4H, m)

Example 77

3-(β-D-Glucopyranosyloxy)-4-[(4-{3-[(*S*)-1-{[4-(2-hydroxyethyl)piperazin-1-yl]carbonyl}ethylcarbamoyl]propyl}-phenyl)methyl]-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 74 using 1-(2-hydroxyethyl)piperazine instead of 2-amino-1,3-propanediol.

^{1}H—NMR (CD_3OD) δ ppm:

1.1-1.15 (6H, m), 1.26 (3H, d, J=6.9Hz), 1.8-1.95 (2H, m), 2.2 (2H, t, J=7.4Hz), 2.4-2.65 (8H, m), 2.85-2.95 (1H, m), 3.2-3.45 (4H, m), 3.45-3.75 (8H, m), 3.77 (1H, d, J=16.4Hz), 3.83 (1H, d, J=11.9Hz), 4.75-4.9 (1H, m), 5.0-5.1 (1H, m), 7.0-7.15 (4H,

m)

Reference Example 22

(4-Benzyloxy-2-methylphenyl)methanol

To a solution of 4-bromo-3-methylphenol (10 g) in *N*,*N*-dimethylformamide (50 mL) were added potassium carbonate (8.87 g) and benzyl bromide (6.36 mL), and the mixture was stirred at room temperature overnight. The reaction mixture was poured into water, and the resulting mixture was extracted with diethyl ether. The organic layer was washed with water and dried over anhydrous magnesium sulfate. The solvent was removed under reduced pressure to give 4-benzyloxy-1-bromo-2-methylbenzene (14.6 g). This material was dissolved in tetrahydrofuran (200 mL). To the solution was added *n*-butyl lithium (2.66 mol/L *n*-hexane solution, 21.7 mL) at -78°C under an argon atmosphere, and the mixture was stirred for 10 minutes. To the reaction mixture was added *N*,*N*-dimethylformamide (10.1 mL), and the mixture was allowed to warm to 0°C and stirred for 30 minutes. The reaction mixture was poured into water, and the resulting mixture was extracted with diethyl ether. The organic layer was washed with water and dried over anhydrous magnesium sulfate. The solvent was removed under reduced pressure to give 4-benzyloxy-2-methylbenzaldehyde. This material was dissolved in ethanol (100 mL). To the solution was added sodium borohydride (1.99 g), and the mixture was stirred at room temperature overnight. To the reaction mixture was added methanol, and the resulting mixture was concentrated under

reduced pressure. To the residue was added a saturated aqueous sodium hydrogen carbonate solution, and the mixture was extracted with diethyl ether. The organic layer was washed with a saturated aqueous sodium hydrogen carbonate solution, water and brine successively, and dried over anhydrous magnesium sulfate. The solvent was removed under reduced pressure, and the residue was purified by column chromatography on silica gel (eluent: *n*-hexane/ethyl acetate = 6/1 - 3/1 - 1/1) to give the title compound (10.5 g).

^{1}H−NMR ($CDCl_3$) δ ppm:

1.37 (1H, t, J=5.8Hz), 2.36 (3H, s), 4.64 (2H, d, J=5.8Hz), 5.06 (2H, s), 6.79 (1H, dd, J=8.4Hz, 2.4Hz), 6.84 (1H, d, J=2.4Hz), 7.23 (1H, d, J=8.4Hz), 7.25-7.45 (5H, m)

Reference Example 23

4-[(4-Benzyloxy-2-methylphenyl)methyl]-1,2-dihydro-5-isopropyl-3*H*-pyrazol-3-one

To a solution of (4-benzyloxy-2-methylphenyl)methanol (10.5 g) in tetrahydrofuran (80 mL) were added triethylamine (7.36 mL) and methanesulfonyl chloride (3.91 mL) under ice-cooling. After the mixture was stirred for 1 hour, the insoluble material was removed by filtration. The obtained solution of (4-benzyloxy-2-methylphenyl)methyl mesylate in tetrahydrofuran was added to a suspension of sodium hydride (60%, 2.11 g) and ethyl 4-methyl-3-oxopentanoate (7.99 g) in tetrahydrofuran (160 mL), and the mixture was refluxed for 15 hours. To the reaction mixture was added 1 mol/L hydrochloric

acid, and the resulting mixture was extracted with diethyl ether. The organic layer was washed with water and dried over anhydrous magnesium sulfate. The solvent was removed under reduced pressure. The residue was dissolved in toluene (30 mL). Hydrazine monohydrate (6.68 mL) was added to the solution, and the mixture was stirred at 100°C overnight. The reaction mixture was poured into water, and the mixture was extracted with ethyl acetate. The organic layer was washed with brine and dried over anhydrous magnesium sulfate. The solvent was removed under reduced pressure, and the residue was treated with *n*-hexane. The precipitated crystals were collected by filtration, and dried under reduced pressure to give the title compound (12.3 g).
^{1}H−NMR (DMSO-d_6) δ ppm:
1.04 (6H, d, J=6.8Hz), 2.24 (3H, s), 2.65-2.8 (1H, m), 3.44 (2H, s), 5.02 (2H, s), 6.69 (1H, dd, J=8.7Hz, 2.4Hz), 6.75-6.85 (2H, m), 7.25-7.45 (5H, m)

Reference Example 24

4-[(4-Benzyloxy-2-methylphenyl)methyl]-5-isopropyl-3-(2,3,4,6-tetra-*O*-pivaloyl-β-D-glucopyranosyloxy)-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Reference Example 12 using 4-[(4-benzyloxy-2-methylphenyl)methyl]-1,2-dihydro-5-isopropyl-3*H*-pyrazol-3-one and 2,3,4,6-tetra-*O*-pivaloyl-α-D-glucopyranosyl bromide (Kunz,H.; Harreus,A. Liebigs Ann. Chem. 1982, 41-48 Velarde,S.; Urbina,J.; Pena,M.R. J.Org.Chem. 1996, 61, 9541-9545) instead

of 4-{[4-(2-benzyloxycarbonyl-2-methylpropoxy)phenyl]-methyl}-1,2-dihydro-5-isopropyl-3*H*-pyrazol-3-one and acetobromo-α-D-glucose, respectively.

^{1}H—NMR ($CDCl_3$) δ ppm:

1.04 (9H, s), 1.05-1.2 (33H, m), 2.27 (3H, s), 2.7-2.85 (1H, m), 3.45-3.6 (2H, m), 3.8-3.9 (1H, m), 4.11 (1H, dd, J=12.6Hz, 4.8Hz), 4.17 (1H, dd, J=12.6Hz, 1.8Hz), 5.0 (2H, s), 5.15-5.3 (2H, m), 5.37 (1H, t, J=9.5Hz), 5.65 (1H, d, J=7.8Hz), 6.64 (1H, dd, J=8.4Hz, 2.8Hz), 6.77 (1H, d, J=2.8Hz), 6.83 (1H, d, J=8.4Hz), 7.25-7.45 (5H, m)

Reference Example 25

4-[(4-Hydroxy-2-methylphenyl)methyl]-5-isopropyl-3-(2,3,4,6-tetra-*O*-pivaloyl-β-D-glucopyranosyloxy)-1*H*-pyrazole

4-[(4-Benzyloxy-2-methylphenyl)methyl]-5-isopropyl-3-(2,3,4,6-tetra-*O*-pivaloyl-β-D-glucopyranosyloxy)-1*H*-pyrazole (5 g) was dissolved in tetrahydrofuran (18 mL). To the solution was added 10% palladium-carbon powder (500 mg), and the mixture was stirred at room temperature under a hydrogen atmosphere for 3 hours. The insoluble material was removed by filtration, and the solvent of the filtrate was removed under reduced pressure to give the title compound (4.45 g).

^{1}H—NMR ($CDCl_3$) δ ppm:

1.0-1.2 (42H, m), 2.24 (3H, s), 2.7-2.85 (1H, m), 3.52 (2H, s), 3.8-3.9 (1H, m), 4.09 (1H, dd, J=12.4Hz, 4.7Hz), 4.15 (1H, dd, J=12.4Hz, 1.9Hz), 4.6 (1H, s), 5.15-5.25 (2H, m), 5.36 (1H, t,

J=9.2Hz), 5.65 (1H, d, J=8.0Hz), 6.5 (1H, dd, J=8.3Hz, 2.9Hz), 6.61 (1H, d, J=2.9Hz), 6.78 (1H, d, J=8.3Hz)

Reference Example 26

Benzyl 4-bromobutyrate

To a mixture of 4-bromobutyric acid (1 g), benzyl alcohol (0.65 g) and triphenyl phosphine (1.57 g) in tetrahydrofuran (12 mL) was added diethyl azodicarboxylate (40% toluene solution, 2.88 mL), and the mixture was stirred at room temperature for 3 hours. The reaction mixture was poured into water, and the resulting mixture was extracted with diethyl ether. The extract was washed with water and brine, and dried over anhydrous magnesium sulfate. The solvent was removed under reduced pressure, and the residue was purified by column chromatography on silica gel (eluent: *n*-hexane/ethyl acetate = 20/1) to give the title compound (0.69 g).

^{1}H−NMR ($CDCl_3$) δ ppm:

2.15-2.25 (2H, m), 2.56 (2H, t, J=7.1Hz), 3.46 (2H, t, J=6.5Hz), 5.13 (2H, s), 7.25-7.4 (5H, m)

Reference Example 27

4-({4-[3-(Benzyloxycarbonyl)propoxy]-2-methylphenyl}-methyl)-5-isopropyl-3-(2,3,4,6-tetra-*O*-pivaloyl-β-D-glucopyranosyloxy)-1*H*-pyrazole

To a solution of 4-[(4-hydroxy-2-methylphenyl)methyl]-5-isopropyl-3-(2,3,4,6-tetra-*O*-pivaloyl-β-D-glucopyranosyl-oxy)-1*H*-pyrazole (0.2 g) in *N*,*N*-dimethylformamide (3 mL) were

added benzyl 4-bromobutyrate (0.1 g), cesium carbonate (0.18 g) and a catalytic amount of sodium iodide, and the mixture was stirred at room temperature overnight. The reaction mixture was poured into water, and the resulting mixture was extracted with ethyl acetate. The extract was washed with water and brine, and dried over anhydrous magnesium sulfate. The solvent was removed under reduced pressure, and the residue was purified by column chromatography on silica gel (eluent: *n*-hexane/ethyl acetate = 3/1 - 2/1) to give the title compound (0.16 g).

^{1}H—NMR ($CDCl_3$) δ ppm:

1.04 (9H, s), 1.05-1.2 (33H, m), 2.05-2.15 (2H, m), 2.25 (3H, s), 2.56 (2H, t, J=7.3Hz), 2.7-2.85 (1H, m), 3.53 (2H, s), 3.8-3.9 (1H, m), 3.94 (2H, t, J=6.2Hz), 4.1 (1H, dd, J=12.5Hz, 4.1Hz), 4.16 (1H, dd, J=12.5Hz, 2.0Hz), 5.13 (2H, s), 5.15-5.25 (2H, m), 5.36 (1H, t, J=9.6Hz), 5.65 (1H, d, J=8.1Hz), 6.54 (1H, dd, J=8.5Hz, 2.7Hz), 6.64 (1H, d, J=2.7Hz), 6.81 (1H, d, J=8.5Hz), 7.25-7.4 (5H, m)

Reference Example 28

1,2-Dihydro-4-[(4-iodophenyl)methyl]-5-isopropyl-3*H*-pyrazol-3-one

The title compound was prepared in a similar manner to that described in Reference Example 23 using 4-iodobenzyl alcohol instead of (4-benzyloxy-2-methylphenyl)methanol.

^{1}H—NMR (CD_3OD) δ ppm:

1.12 (6H, d, J=7.3Hz), 2.8-2.95 (1H, m), 3.63 (2H, s), 6.9-7.0 (2H, m), 7.5-7.6 (2H, m)

Reference Example 29

3-(2,3,4,6-Tetra-*O*-acetyl-β-D-galactopyranosyloxy)-4-[(4-iodophenyl)methyl]-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Reference Example 12 using 1,2-dihydro-4-[(4-iodophenyl)methyl]-5-isopropyl-3*H*-pyrazol-3-one and acetobromo-α-D-galactose instead of 4-{[4-(2-benzyloxycarbonyl-2-methylpropoxy)phenyl]methyl}-1,2-dihydro-5-isopropyl-3*H*-pyrazol-3-one and acetobromo-α-D-glucose, respectively.

^{1}H−NMR ($CDCl_3$) δ ppm:

1.15-1.2 (6H, m), 1.88 (3H, s), 1.99 (3H, s), 2.03 (3H, s), 2.18 (3H, s), 2.8-2.95 (1H, m), 3.58 (1H, d, J=16.0Hz), 3.65 (1H, d, J=16.0Hz), 4.0-4.1 (1H, m), 4.15-4.25 (2H, m), 5.09 (1H, dd, J=10.7Hz, 3.5Hz), 5.35-5.45 (2H, m), 5.56 (1H, d, J=8.3Hz), 6.85-6.95 (2H, m), 7.5-7.6 (2H, m)

Reference Example 30

{4-[2-(Benzyloxycarbonyl)ethoxy]phenyl}methanol

To a mixture of 3-[4-(hydroxymethyl)phenoxy]propionic acid (0.98 g) and potassium carbonate (0.9 g) in *N*,*N*-dimethylformamide (5 mL) was added benzyl bromide (0.65 mL), and the mixture was stirred at room temperature overnight. The reaction mixture was poured into water, and the resulting mixture was extracted with diethyl ether. The extract was washed with water and brine, and dried over anhydrous sodium sulfate. The solvent

was removed under reduced pressure, and the residue was purified by column chromatography on silica gel (eluent: *n*-hexane/ethyl acetate = 2/1 - 1/1) to give the title compound (1.1 g).

^{1}H−NMR ($CDCl_3$) δ ppm:

1.5-1.55 (1H, m), 2.85 (2H, t, J=6.4Hz), 4.28 (2H, t, J=6.4Hz), 4.62 (2H, d, J=5.9Hz), 5.18 (2H, s), 6.85-6.9 (2H, m), 7.25-7.4 (7H, m)

Reference Example 31

4-Hydroxy-2-methylbenzaldehyde

To a solution of 4-bromo-3-methylphenol (14 g) and *N*,*N*-diisopropylamine (39.1 mL) in dichloromethane (150 mL) was added chloromethyl methyl ether (11.4 mL) under ice-cooling, and the mixture was stirred at room temperature for 5 days. The reaction mixture was poured into a saturated aqueous citric acid solution, and the resulting mixture was extracted with diethyl ether. The extract was washed with water, 1 mol/L aqueous sodium hydroxide solution, water and brine successively, and dried over anhydrous sodium sulfate. The solvent was removed under reduced pressure to give 4-bromo-3-methyl-1-(methoxymethoxy)benzene (16.7 g). This material was dissolved in tetrahydrofuran (250 mL). To the solution was added *n*-butyl lithium (2.64 mol/L *n*-hexane solution, 32.7 mL) at -78°C under an argon atmosphere, and the mixture was stirred at the same temperature for 15 minutes. To the reaction mixture was added *N*,*N*-dimethylformamide (16.6 mL), and the mixture was stirred under ice-cooling for 1 hour. The reaction mixture was poured into a saturated aqueous ammonium

chloride solution, and the resulting mixture was extracted with diethyl ether. The extract was washed with a saturated aqueous sodium hydrogen carbonate solution and brine, and dried over anhydrous sodium sulfate. The solvent was removed under reduced pressure to give 2-methyl-4-(methoxymethoxy)benzaldehyde (12.9 g). This material was dissolved in tetrahydrofuran (70 mL)-methanol (10 mL). To the solution was added concentrated hydrochloric acid (6 mL), and the mixture was stirred at 50°C for 1.5 hours. The reaction mixture was poured into a saturated aqueous sodium hydrogen carbonate solution, and the resulting mixture was extracted with ethyl acetate. The extract was washed with brine, and dried over anhydrous sodium sulfate. The solvent was removed under reduced pressure. The residue was dissolved in ethyl acetate (30 mL) with heating at 60°C. *n*-Hexane (100 mL) was added to the solution gently, and the mixture was stirred at the same temperature for 10 minutes. The mixture was cooled to room temperature. *n*-Hexane (170 mL) was added to the mixture, and the resulting mixture was stirred overnight. The precipitated crystals were collected by filtration, and washed with *n*-hexane and dried under reduced pressure to give the title compound (5.6 g).

^{1}H—NMR ($CDCl_3$) δ ppm:

2.63 (3H, s), 5.47 (1H, s), 6.7 (1H, d, J=2.3Hz), 6.79 (1H, dd, J=8.4Hz, 2.3Hz), 7.73 (1H, d, J=8.4Hz), 10.11 (1H, s)

Reference Example 32

4-(2-Carboxyethoxy)-2-methylbenzaldehyde

To a mixture of 4-hydroxy-2-methylbenzaldehyde (5 g) and potassium *tert*-butoxide (4.12 g) in tetrahydrofuran (60 mL) was added β-propiolactone (4.6 mL), and the mixture was stirred at room temperature for 4 hours. The reaction mixture was poured into 1 mol/L hydrochloric acid, and the resulting mixture was extracted with ethyl acetate. The extract was washed with water and brine, and dried over anhydrous sodium sulfate. The solvent was removed under reduced pressure. The residue was suspended in ethyl acetate (20 mL) - *n*-hexane (100 mL). The insoluble material was collected by filtration, and washed with *n*-hexane and dried under reduced pressure to give the title compound (7.2 g).

^{1}H−NMR ($CDCl_3$) δ ppm:
2.65 (3H, s), 2.89 (2H, t, J=6.4Hz), 4.32 (2H, t, J=6.4Hz), 6.76 (1H, d, J=2.5Hz), 6.85 (1H, dd, J=8.7Hz, 2.5Hz), 7.76 (1H, d, J=8.7Hz), 10.12 (1H, s)

Reference Example 33

4-[2-(Benzyloxycarbonyl)ethoxy]-2-methylbenzaldehyde

To a suspension of 4-(2-carboxyethoxy)-2-methyl-benzaldehyde (7.2 g) and potassium carbonate (14.3 g) in *N*,*N*-dimethylformamide (70 mL) was added benzyl bromide (8.2 mL) at room temperature, and the mixture was stirred overnight. The reaction mixture was poured into water, and the resulting mixture was extracted with diethyl ether. The extract was washed with water and brine, and dried over anhydrous sodium sulfate. The solvent was removed under reduced pressure, and the residue was

purified by column chromatography on silica gel (eluent: *n*-hexane/ethyl acetate = 4/1 - 3/1) to give the title compound (6.47 g).

^{1}H−NMR ($CDCl_3$) δ ppm:

2.64 (3H, s), 2.88 (2H, t, J=6.3Hz), 4.34 (2H, t, J=6.3Hz), 5.19 (2H, s), 6.73 (1H, d, J=2.4Hz), 6.83 (1H, dd, J=8.5Hz, 2.4Hz), 7.3-7.4 (5H, m), 7.75 (1H, d, J=8.5Hz), 10.12 (1H, s)

Reference Example 34

{4-[2-(Benzyloxycarbonyl)ethoxy]-2-methylphenyl}methanol

The title compound was prepared in a similar manner to that described in Reference Example 10 using 4-[2-(benzyloxycarbonyl)ethoxy]-2-methylbenzaldehyde instead of 4-(2-benzyloxycarbonyl-2-methylpropoxy)benzaldehyde.

^{1}H−NMR ($CDCl_3$) δ ppm:

1.38 (1H, t, J=5.7Hz), 2.35 (3H, s), 2.84 (2H, t, J=6.4Hz), 4.26 (2H, t, J=6.4Hz), 4.63 (2H, d, J=5.7Hz), 5.18 (2H, s), 6.7-6.75 (2H, m), 7.22 (1H, d, J=8.2Hz), 7.3-7.4 (5H, m)

Reference Example 35

4-({4-[2-(Benzyloxycarbonyl)ethoxy]phenyl}methyl)-1,2-dihydro-5-isopropyl-3*H*-pyrazol-3-one

The title compound was prepared in a similar manner to that described in Reference Example 11 using {4-[2-(benzyloxycarbonyl)ethoxy]phenyl}methanol instead of [4-(2-benzyloxycarbonyl-2-methylpropoxy)phenyl]methanol.

^{1}H−NMR (DMSO-d_6) δ ppm:

1.05-1.1 (6H, m), 2.75-2.85 (3H, m), 3.5 (2H, s), 4.16 (2H, t, J=5.9Hz), 5.14 (2H, s), 6.75-6.8 (2H, m), 7.0-7.05 (2H, m), 7.3-7.4 (5H, m)

Reference Example 36

4-({4-[2-(Benzyloxycarbonyl)ethoxy]-2-methylphenyl}methyl)-5-isopropyl-3*H*-pyrazol-3-one

The title compound was prepared in a similar manner to that described in Reference Example 11 using {4-[2-(benzyloxycarbonyl)ethoxy]-2-methylphenyl}methanol instead of [4-(2-benzyloxycarbonyl-2-methylpropoxy)phenyl]methanol.

^{1}H−NMR ($CDCl_3$) δ ppm:

1.12 (6H, d, J=6.8Hz), 2.3 (3H, s), 2.75-2.9 (3H, m), 3.6 (2H, s), 4.23 (2H, t, J=6.2Hz), 5.17 (2H, s), 6.62 (1H, dd, J=8.5Hz, 2.7Hz), 6.7 (1H, d, J=2.7Hz), 6.94 (1H, d, J=8.5Hz), 7.25-7.4 (5H, m)

Reference Example 37

3-(2,3,4,6-Tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-({4-[2-(benzyloxycarbonyl)ethoxy]phenyl}methyl)-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Reference Example 12 using 4-({4-[2-(benzyloxycarbonyl)ethoxy]phenyl}methyl)-1,2-dihydro-5-isopropyl-3*H*-pyrazol-3-one instead of 4-{[4-(2-benzyloxycarbonyl-2-methylpropoxy)phenyl]methyl}-1,2-dihydro-5-isopropyl-3*H*-pyrazol-3-one.

^{1}H−NMR ($CDCl_3$) δ ppm:

1.1-1.2 (6H, m), 1.87 (3H, s), 2.01 (3H, s), 2.03 (3H, s), 2.06 (3H, s), 2.82 (2H, t, J=6.4Hz), 2.85-2.95 (1H, m), 3.57 (1H, d, J=15.9Hz), 3.63 (1H, d, J=15.9Hz), 3.8-3.9 (1H, m), 4.1-4.15 (1H, m), 4.22 (2H, t, J=6.4Hz), 4.31 (1H, dd, J=12.4Hz, 4.0Hz), 5.16 (2H, s), 5.2-5.3 (3H, m), 5.58 (1H, d, J=7.6Hz), 6.7-6.8 (2H, m), 7.0-7.05 (2H, m), 7.3-7.4 (5H, m)

Reference Example 38

3-(2,3,4,6-Tetra-*O*-acetyl-β-D-galactopyranosyloxy)-4-({4-[2-(benzyloxycarbonyl)ethoxy]phenyl}methyl)-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Reference Example 12 using 4-({4-[2-(benzyloxycarbonyl)ethoxy]phenyl}methyl)-1,2-dihydro-5-isopropyl-3*H*-pyrazol-3-one and acetobromo-α-D-galactose instead of 4-{[4-(2-benzyloxycarbonyl-2-methylpropoxy)phenyl]methyl}-1,2-dihydro-5-isopropyl-3*H*-pyrazol-3-one and acetobromo-α-D-glucose, respectively.

^{1}H−NMR ($CDCl_3$) δ ppm:

1.1-1.2 (6H, m), 1.88 (3H, s), 1.99 (3H, s), 2.02 (3H, s), 2.17 (3H, s), 2.8-2.9 (3H, m), 3.58 (1H, d, J=16.1Hz), 3.65 (1H, d, J=16.1Hz), 4.0-4.25 (5H, m), 5.09 (1H, dd, J=10.4Hz, 3.5Hz), 5.17 (2H, s), 5.4-5.45 (2H, m), 5.55 (1H, d, J=8.2Hz), 6.7-6.8 (2H, m), 7.0-7.05 (2H, m), 7.25-7.35 (5H, m)

Reference Example 39

3-(2,3,4,6-Tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-({4-[2-(benzyloxycarbonyl)ethoxy]-2-methylphenyl}methyl)-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Reference Example 12 using 4-({4-[2-(benzyloxycarbonyl)ethoxy]-2-methylphenyl}methyl)- 5-isopropyl-3*H*-pyrazol-3-one instead of 4-{[4-(2-benzyloxycarbonyl-2-methylpropoxy)phenyl]methyl}-1,2-dihydro-5-isopropyl-3*H*-pyrazol-3-one.

^{1}H−NMR ($CDCl_3$) δ ppm:

1.05-1.15 (6H, m), 1.8 (3H, s), 1.99 (3H, s), 2.02 (3H, s), 2.06 (3H, s), 2.25 (3H, s), 2.7-2.85 (3H, m), 3.49 (1H, d, J=16.2Hz), 3.59 (1H, d, J=16.2Hz), 3.8-3.9 (1H, m), 4.12 (1H, dd, J=12.4Hz, 2.3Hz), 4.21 (2H, t, J=6.6Hz), 4.3 (1H, dd, J=12.4Hz, 4.0Hz), 5.15-5.3 (5H, m), 5.56 (1H, d, J=8.0Hz), 6.57 (1H, dd, J=8.5Hz, 2.4Hz), 6.67 (1H, d, J=2.4Hz), 6.8 (1H, d, J=8.5Hz), 7.25-7.4 (5H, m)

Reference Example 40

3-(2,3,4,6-Tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-{[4-(2-carboxyethoxy)phenyl]methyl}-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Reference Example 13 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-({4-[2-(benzyloxycarbonyl)ethoxy]phenyl}methyl)-5-isopropyl-1*H*-pyrazole instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-{[4-(2-benzyloxycarbonyl-2-methylpropoxy)phenyl]methyl}-

5-isopropyl-1*H*-pyrazole.

^{1}H-NMR (CD_3OD) δ ppm:

1.1-1.15 (6H, m), 1.89 (3H, s), 1.97 (3H, s), 2.0 (3H, s), 2.02 (3H, s), 2.71 (2H, t, J=6.2Hz), 2.85-2.95 (1H, m), 3.6 (2H, s), 3.9-3.95 (1H, m), 4.1-4.15 (1H, m), 4.18 (2H, t, J=6.2Hz), 4.3 (1H, dd, J=12.4Hz, 4.0Hz), 5.05-5.15 (2H, m), 5.25-5.35 (1H, m), 5.48 (1H, d, J=8.0Hz), 6.75-6.8 (2H, m), 7.0-7.05 (2H, m)

Reference Example 41

3-(2,3,4,6-Tetra-*O*-acetyl-β-D-galactopyranosyloxy)-4-{[4-(2-carboxyethoxy)phenyl]methyl}-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Reference Example 13 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-galactopyranosyloxy)-4-({4-[2-(benzyloxycarbonyl)ethoxy]phenyl}methyl)-5-isopropyl-1*H*-pyrazole instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-{[4-(2-benzyloxycarbonyl-2-methylpropoxy)phenyl]methyl}-5-isopropyl-1*H*-pyrazole.

^{1}H-NMR (CD_3OD) δ ppm:

1.1-1.2 (6H, m), 1.9 (3H, s), 1.95 (3H, s), 1.99 (3H, s), 2.16 (3H, s), 2.71 (2H, t, J=6.1Hz), 2.85-2.95 (1H, m), 3.61 (2H, s), 4.05-4.2 (5H, m), 5.19 (1H, dd, J=10.4Hz, 3.5Hz), 5.25-5.35 (1H, m), 5.4-5.45 (1H, m), 5.46 (1H, d, J=8.1Hz), 6.75-6.8 (2H, m), 7.0-7.05 (2H, m)

Reference Example 42

3-(2,3,4,6-Tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-{[4-(2-

carboxyethoxy)-2-methylphenyl]methyl}-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Reference Example 13 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-({4-[2-(benzyloxycarbonyl)ethoxy]-2-methylphenyl}methyl)-5-isopropyl-1*H*-pyrazole instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-{[4-(2-benzyloxycarbonyl-2-methylpropoxy)-phenyl]methyl}-5-isopropyl-1*H*—pyrazole.

^{1}H—NMR (CD_3OD) δ ppm:

1.1-1.15 (6H, m), 1.82 (3H, s), 1.96 (3H, s), 2.0 (3H, s), 2.02 (3H, s), 2.26 (3H, s), 2.7 (2H, t, J=6.2Hz), 2.75-2.9 (1H, m), 3.53 (1H, d, J=16.4Hz), 3.58 (1H, d, J=16.4Hz), 3.85-3.95 (1H, m), 4.08 (1H, dd, J=12.4Hz, 2.4Hz), 4.17 (2H, t, J=6.2Hz), 4.28 (1H, dd, J=12.4Hz, 4.1Hz), 5.0-5.15 (2H, m), 5.27 (1H, t, J=9.6Hz), 5.43 (1H, d, J=7.9Hz), 6.61 (1H, dd, J=8.5Hz, 2.5Hz), 6.71 (1H, d, J=2.5Hz), 6.77 (1H, d, J=8.5Hz)

Reference Example 43

4-{[4-(3-Carboxypropoxy)-2-methylphenyl]methyl}-5-isopropyl-3-(2,3,4,6-tetra-O-pivaloyl-β-D-glucopyranosyl-oxy)-1H-pyrazole

The title compound was prepared in a similar manner to that described in Reference Example 25 using 4-({4-[3-(benzyl-oxycarbonyl)propoxy]-2-methylphenyl}methyl)-5-isopropyl-3-(2,3,4,6-tetra-*O*-pivaloyl-β-D-glucopyranosyloxy)-1*H*-pyrazole instead of 4-[(4-benzyloxy-2-methylphenyl)methyl]-

5-isopropyl-3-(2,3,4,6-tetra-*O*-pivaloyl-β-D-glucopyranosyl-oxy)-1*H*-pyrazole.

^{1}H—NMR ($CDCl_3$) δ ppm:

1.04 (9H, s), 1.05-1.2 (33H, m), 2.05-2.15 (2H, m), 2.25 (3H, s), 2.5-2.6 (2H, m), 2.7-2.8 (1H, m), 3.52 (2H, s), 3.8-3.9 (1H, m), 3.95-4.0 (2H, m), 4.05-4.15 (1H, m), 4.17 (1H, dd, J=12.4Hz, 1.9Hz), 5.15-5.3 (2H, m), 5.36 (1H, t, J=9.4Hz), 5.53 (1H, d, J=8.3Hz), 6.57 (1H, dd, J=8.4Hz, 2.7Hz), 6.67 (1H, d, J=2.7Hz), 6.81 (1H, d, J=8.4Hz)

Reference Example 44

Benzyl 2-amino-2-methylpropinate hydrochloride

To a solution of 2-(*tert*-butoxycarbonylamino)-2-methyl-propionic acid (4.06 g) in *N*,*N*-dimethylformamide (40 mL) were added potassium carbonate (4.15 g) and benzyl bromide (2.85 mL), and the mixture was stirred at room temperature for 2 hours. The reaction mixture was poured into water, and the resulting mixture was extracted with ethyl acetate. The extract was washed with water and brine, and dried over anhydrous sodium sulfate. The solvent was removed under reduced pressure. The residue (solid) was treated with *n*-hexane and collected by filtration. The crystals were dried under reduced pressure to give benzyl 2-(*tert*-butoxycarbonylamino)-2-methylpropionate (4.44 g). Hydrochloric acid (4 mol/L 1,4-dioxane solution, 15 mL) was added to the obtained benzyl 2-(*tert*-butoxycarbonylamino)-2-methyl-propionate (4.44 g), and the mixture was stirred at room temperature overnight. The reaction mixture was diluted with

diethyl ether, and the resulting mixture was stirred for 1 hour. The insoluble material was collected by filtration, and washed with diethyl ether and dried under reduced pressure to give the title compound (3.4 g).

^{1}H−NMR (DMSO-d_6) δ ppm:

1.49 (6H, s), 5.25 (2H, s), 7.3-7.45 (5H, m), 8.54 (3H, brs)

Reference Example 45

3-(2,3,4,6-Tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-{2-[1-benzyloxycarbonyl-1-(methyl)ethylcarbamoyl]ethoxy}-2-methylphenyl)methyl]-5-isopropyl-1*H*-pyrazole

To a solution of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-{[4-(2-carboxyethoxy)-2-methylphenyl]-methyl}-5-isopropyl-1*H*-pyrazole (0.14 g) in *N*,*N*-dimethylformamide (3 mL) were added benzyl 2-amino-2-methylpropionate hydrochloride (57 mg), 1-hydroxybenzotriazole (31 mg), 1-ethyl-3-(3-dimethylaminopropyl)carbodiimide hydrochloride (60 mg) and triethylamine (0.087 mL), and the mixture was stirred at room temperature for 4 hours. The reaction mixture was poured into water, and the resulting mixture was extracted with ethyl acetate. The extract was washed with water and brine, and dried over anhydrous sodium sulfate. The solvent was removed under reduced pressure, and the residue was purified by column chromatography on silica gel (eluent: dichloromethane/methanol = 40/1 - 20/1) to give the title compound (0.15 g).

^{1}H−NMR ($CDCl_3$) δ ppm:

1.1-1.15 (6H, m), 1.56 (6H, s), 1.81 (3H, s), 1.99 (3H, s), 2.02

(3H, s), 2.05 (3H, s), 2.25 (3H, s), 2.6 (2H, t, J=6.1Hz), 2.75-2.85 (1H, m), 3.5 (1H, d, J=16.7Hz), 3.59 (1H, d, J=16.7Hz), 3.8-3.9 (1H, m), 4.05-4.2 (3H, m), 4.29 (1H, dd, J=12.5Hz, 4.0Hz), 5.1-5.3 (5H, m), 5.56 (1H, d, J=8.1Hz), 6.53 (1H, brs), 6.57 (1H, dd, J=8.5Hz, 2.5Hz), 6.67 (1H, d, J=2.5Hz), 6.8 (1H, d, J=8.5Hz), 7.25-7.4 (5H, m)

Reference Example 46

3-(2,3,4,6-Tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-{2-[(*S*)-1-(benzyloxycarbonyl)ethylcarbamoyl]ethoxy}-2-methylphenyl)methyl]-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Reference Example 45 using benzyl (*S*)-2-aminopropionate *p*-toluenesulfonic acid salt instead of benzyl 2-amino-2-methylpropionate hydrochloride.

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.15 (6H, m), 1.38 (3H, d, J=7.3Hz), 1.82 (3H, s), 1.95 (3H, s), 2.0 (3H, s), 2.01 (3H, s), 2.25 (3H, s), 2.6-2.7 (2H, m), 2.75-2.9 (1H, m), 3.52 (1H, d, J=16.5Hz), 3.58 (1H, d, J=16.5Hz), 3.85-3.95 (1H, m), 4.07 (1H, dd, J=12.2Hz, 2.5Hz), 4.1-4.2 (2H, m), 4.27 (1H, dd, J=12.2Hz, 4.2Hz), 4.4-4.5 (1H, m), 5.0-5.2 (4H, m), 5.28 (1H, t, J=9.5Hz), 5.43 (1H, d, J=7.9Hz), 6.58 (1H, dd, J=8.5Hz, 2.2Hz), 6.69 (1H, d, J=2.2Hz), 6.76 (1H, d, J=8.5Hz), 7.25-7.4 (5H, m)

Reference Example 47

4-[(4-{3-[1-Benzyloxycarbonyl-1-(methyl)ethylcarbamoyl]-

propoxy}-2-methylphenyl)methyl]-5-isopropyl-3-(2,3,4,6-tetra-*O*-pivaloyl-β-D-glucopyranosyloxy)-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Reference Example 45 using 4-{[4-(3-carboxypropoxy)-2-methylphenyl]methyl}-5-isopropyl-3-(2,3,4,6-tetra-*O*-pivaloyl-β-D-glucopyranosyloxy)-1*H*-pyrazole instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-{[4-(2-carboxyethoxy)-2-methylphenyl]methyl}-5-isopropyl-1*H*-pyrazole.

^{1}H—NMR ($CDCl_3$) δ ppm:

1.0-1.2 (42H, m), 1.52 (6H, s), 1.95-2.1 (2H, m), 2.25 (3H, s), 2.34 (2H, t, J=7.3Hz), 2.7-2.85 (1H, m), 3.52 (2H, s), 3.8-3.95 (3H,m), 4.05-4.2(2H,m), 5.1-5.25(4H,m), 5.36(1H,t,J=9.1Hz), 5.65 (1H, d, J=8.3Hz), 6.05 (1H, brs), 6.53 (1H, dd, J=8.2Hz, 2.5Hz), 6.65 (1H, d, J=2.5Hz), 6.81 (1H, d, J=8.2Hz), 7.25-7.4 (5H, m)

Reference Example 48

3-(2,3,4,6-Tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-{2-[1-carboxy-1-(methyl)ethylcarbamoyl]ethoxy}-2-methylphenyl)methyl]-5-isopropyl-1*H*-pyrazole

3-(2,3,4,6-Tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-{2-[1-benzyloxycarbonyl-1-(methyl)ethylcarbamoyl]-ethoxy}-2-methylphenyl)methyl]-5-isopropyl-1*H*-pyrazole (0.15 g) was dissolved in methanol (5 mL). To the solution was added 10% palladium-carbon powder (50 mg), and the mixture was stirred at room temperature under a hydrogen atmosphere overnight.

The insoluble material was removed by filtration, and the solvent of the filtrate was removed under reduced pressure to give the title compound (0.13 g).

^{1}H—NMR (CD_3OD) δ ppm:

1.05-1.15 (6H, m), 1.47 (6H, s), 1.82 (3H, s), 1.96 (3H, s), 2.0 (3H, s), 2.02 (3H, s), 2.26 (3H, s), 2.6 (2H, t, J=6.3Hz), 2.75-2.9 (1H, m), 3.52 (1H, d, J=16.4Hz), 3.58 (1H, d, J=16.4Hz), 3.85-3.95 (1H, m), 4.07 (1H, dd, J=12.4Hz, 2.2Hz), 4.16 (2H, t, J=6.3Hz), 4.27 (1H, dd, J=12.4Hz, 4.0Hz), 5.0-5.15 (2H, m), 5.28 (1H, t, J=9.5Hz), 5.43 (1H, d, J=8.2Hz), 6.61 (1H, dd, J=8.5Hz, 2.6Hz), 6.71 (1H, d, J=2.6Hz), 6.77 (1H, d, J=8.5Hz)

Reference Example 49

3-(2,3,4,6-Tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-{2-[(*S*)-1-(carboxy)ethylcarbamoyl]ethoxy}-2-methylphenyl)-methyl]-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Reference Example 48 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-{2-[(*S*)-1-(benzyloxy-carbonyl)ethylcarbamoyl]ethoxy}-2-methylphenyl)methyl]-5-isopropyl-1*H*-pyrazole instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-{2-[1-benzyloxycarbonyl-1-(methyl)ethylcarbamoyl]ethoxy}-2-methylphenyl)methyl]-5-isopropyl-1*H*-pyrazole.

^{1}H—NMR (CD_3OD) δ ppm:

1.05-1.15 (6H, m), 1.39 (3H, d, J=7.3Hz), 1.82 (3H, s), 1.96 (3H, s), 2.0 (3H, s), 2.02 (3H, s), 2.26 (3H, s), 2.6-2.7 (2H,

m), 2.75-2.9 (1H, m), 3.52 (1H, d, J=16.6Hz), 3.58 (1H, d, J=16.6Hz), 3.85-3.95 (1H, m), 4.07 (1H, dd, J=12.4Hz, 2.5Hz), 4.1-4.25 (2H, m), 4.27 (1H, dd, J=12.4Hz, 4.0Hz), 4.4 (1H, q, J=7.3Hz), 5.0-5.15 (2H, m), 5.28 (1H, t, J=9.4Hz), 5.43 (1H, d, J=8.0Hz), 6.62 (1H, dd, J=8.3Hz, 2.7Hz), 6.72 (1H, d, J=2.7Hz), 6.77 (1H, d, J=8.3Hz)

Reference Example 50

4-[(4-{3-[1-Carboxy-1-(methyl)ethylcarbamoyl]propoxy}-2-methylphenyl)methyl]-5-isopropyl-3-(2,3,4,6-tetra-*O*-pivaloyl-β-D-glucopyranosyloxy)-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Reference Example 48 using 4-[(4-{3-[1-benzyloxycarbonyl-1-(methyl)ethylcarbamoyl]propoxy}-2-methylpheny l)methyl]-5-isopropyl-3-(2,3,4,6-tetra-*O*-pivaloyl-β-D-glucopyranosyloxy)-1*H*-pyrazole instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-{2-[1-benzyloxycarbonyl-1-(methyl)ethylcarbamoyl]ethoxy}-2-methylphenyl)methyl]-5-isopropyl-1*H*-pyrazole.

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.2 (42H, m), 1.44 (6H, s), 1.95-2.05 (2H, m), 2.26 (3H, s), 2.35 (2H, t, J=7.4Hz), 2.75-2.85 (1H, m), 3.5-3.6 (2H, m), 3.9-4.0 (3H, m), 4.09 (1H, dd, J=12.4Hz, 1.8Hz), 4.17 (1H, dd, J=12.4Hz, 4.2Hz), 5.05-5.2 (2H, m), 5.39 (1H, t, J=9.5Hz), 5.58 (1H, d, J=7.9Hz), 6.58 (1H, dd, J=8.4Hz, 2.6Hz), 6.7 (1H, d, J=2.6Hz), 6.8 (1H, d, J=8.4Hz)

Reference Example 51

3-(2,3,4,6-Tetra-*O*-acetyl-β-D-galactopyranosyloxy)-4-[(4-{4-[1-carboxy-1-(methyl)ethylcarbamoyl]butyl}phenyl)-methyl]-5-isopropyl-1*H*-pyrazole

A mixture of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-galacto-pyranosyloxy)-4-[(4-iodophenyl)methyl]-5-isopropyl-1*H*-pyrazole (0.43 g), 4-pentynoic acid (94 mg), tetrakis-(triphenylphosphine)palladium(0) (37 mg), copper(I)iodide (12 mg) and tiethylamine (0.45 mL) in tetrahydrofuran (5 mL) was stirred at room temperature under an argon atmosphere overnight. The reaction mixture was poured into 0.5 mol/L hydrochloric acid, and the resulting mixture was extracted with ethyl acetate. The extract was washed with water and brine, and dried over anhydrous sodium sulfate. The solvent was removed under reduced pressure, and the residue was purified by column chromatography on silica gel (eluent: *n*-hexane/ethyl acetate = 1/2 - ethyl acetate) to give 3-(2,3,4,6-tetra-*O*-acetyl-β-D-galactopyranosyloxy)-4-{[4-(4-carboxybut-1-ynyl)phenyl]methyl}-5-isopropyl-1*H*-pyrazole (0.37 g). This material was dissolved in *N*,*N*-dimethyl-formamide (6 mL). To the solution were added benzyl 2-amino-2-methylpropionate hydrochloride (0.15 g), 1-hydroxybenzo-triazole (86 mg), 1-ethyl-3-(3-dimethylaminopropyl)-carbodiimide hydrochloride (0.22 g) and triethylamine (0.32 mL), and the mixture was stirred at room temperature overnight. The reaction mixture was poured into 0.5 mol/L hydrochloric acid, and the resulting mixture was extracted with ethyl acetate. The extract was washed with water, a saturated aqueous sodium

hydrogen carbonate solution and brine successively, and dried over anhydrous sodium sulfate. The solvent was removed under reduced pressure, and the residue was purified by column chromatography on silica gel (eluent: dichloromethane/methanol = 20/1) to give 3-(2,3,4,6-tetra-*O*-acetyl-β-D-galacto-pyranosyloxy)-4-[(4-{4-[1-benzyloxycarbonyl-1-(methyl)-ethylcarbamoyl]but-1-ynyl}phenyl)methyl]-5-isopropyl-1*H*-pyrazole (0.36 g). This material was dissolved in methanol (5 mL). To the solution was added 10% palladium-carbon powder (50 mg), and the mixture was stirred at room temperature under a hydrogen atmosphere for 2 hours. The insoluble material was removed by filtration, and the solvent of the filtrate was removed under reduced pressure to give the title compound (0.31 g).

^{1}H−NMR (CD_3OD) δ ppm:

1.1-1.2 (6H, m), 1.44 (6H, s), 1.55-1.65 (4H, m), 1.88 (3H, s), 1.95 (3H, s), 1.99 (3H, s), 2.1-2.2 (5H, m), 2.5-2.6 (2H, m), 2.85-3.0 (1H, m), 3.55-3.7 (2H, m), 4.05-4.2 (3H, m), 5.19 (1H, dd, J=10.4Hz, 3.5Hz), 5.25-5.35 (1H, m), 5.4-5.45 (1H, m), 5.46 (1H, d, J=8.1Hz), 7.0-7.1 (4H, m)

Example 78

4-[(4-{2-[1-Carbamoyl-1-(methyl)ethylcarbamoyl]ethoxy}-2-methylphenyl)methyl]-3-(β-D-glucopyranosyloxy)-5-isopropyl-1*H*-pyrazole

To a solution of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-gluco-pyranosyloxy)-4-{[4-(2-carboxyethoxy)-2-methylphenyl]-methyl}-5-isopropyl-1*H*-pyrazole (0.2 g) in *N*,*N*-dimethyl-

formamide (3 mL) were added 2-amino-2-methylpropionamide (47 mg), 1-hydroxybenzotriazole (50 mg), 1-ethyl-3-(3-dimethylaminopropyl)carbodiimide hydrochloride (118 mg) and triethylamine (0.13 mL), and the mixture was stirred at room temperature overnight. The reaction mixture was poured into water, and the resulting mixture was extracted with ethyl acetate. The extract was washed with water and brine, and dried over anhydrous sodium sulfate. The solvent was removed under reduced pressure, and the residue was purified by column chromatography on silica gel (eluent: dichloromethane/methanol = 20/1 - 10/1) to give 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-{2-[1-carbamoyl-1-(methyl)ethylcarbamoyl]ethoxy}-2-methylphenyl)methyl]-5-isopropyl-1*H*-pyrazole (0.12 g). This material was dissolved in methanol (3 mL). To the solution was added sodium methoxide (28% methanol solution, 0.06 mL), and the mixture was stirred at room temperature for 1 hour. To the reaction mixture was added acetic acid (0.1 mL), and the resulting mixture was concentrated under reduced pressure. The residue was purified by solid phase extraction on ODS (washing solvent: distilled water, eluent: methanol) to give the title compound (80 mg).

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.15 (6H, m), 1.47 (6H, s), 2.29 (3H, s), 2.62 (2H, t, J=6.1Hz), 2.75-2.85 (1H, m), 3.25-3.4 (4H, m), 3.6-3.75 (3H, m), 3.81 (1H, d, J=11.9Hz), 4.18 (2H, t, J=6.1Hz), 4.95-5.05 (1H, m), 6.63 (1H, dd, J=8.4Hz, 2.4Hz), 6.72 (1H, d, J=2.4Hz), 6.86 (1H, d, J=8.4Hz)

Example 79

4-[(4-{2-[1-Carbamoyl-1-(methyl)ethylcarbamoyl]ethoxy}-phenyl)methyl]-3-(β-D-glucopyranosyloxy)-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 78 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-{[4-(2-carboxyethoxy)phenyl]-methyl}-5-isopropyl-1*H*-pyrazole instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-{[4-(2-carboxyethoxy)-2-methylphenyl]methyl}-5-isopropyl-1*H*-pyrazole.

^{1}H−NMR (CD_3OD) δ ppm:

1.5-1.15 (6H, m), 1.47 (6H, s), 2.63 (2H, t, J=6.2Hz), 2.85-2.95 (1H, m), 3.3-3.4 (4H, m), 3.6-3.75 (3H, m), 3.8-3.85 (1H, m), 4.19 (2H, t, J=6.2Hz), 5.05-5.1 (1H, m), 6.8-6.85 (2H, m), 7.1-7.15 (2H, m)

Example 80

3-(β-D-Glucopyranosyloxy)-4-[(4-{2-[2-hydroxy-1,1-di-(methyl)ethylcarbamoyl]ethoxy}phenyl)methyl]-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 78 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-{[4-(2-carboxyethoxy)phenyl]-methyl}-5-isopropyl-1*H*-pyrazole and 2-amino-2-methyl-1-propanol instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-gluco-pyranosyloxy)-4-{[4-(2-carboxyethoxy)-2-methylphenyl]-

methyl}-5-isopropyl-1*H*-pyrazole and 2-amino-2-methyl-propionamide, respectively.

^{1}H−NMR (CD_3OD) δ ppm:

1.1-1.15 (6H, m), 1.27 (6H, s), 2.59 (2H, t, J=6.2Hz), 2.85-2.95 (1H, m), 3.3-3.4 (4H, m), 3.57 (2H, s), 3.6-3.85 (4H, m), 4.16 (2H, t, J=6.2Hz), 5.05-5.1 (1H, m), 6.75-6.85 (2H, m), 7.05-7.15 (2H, m)

Reference Example 52

1-(2-Amino-2-methylpropionyl)-4-methylpiperazine

To a solution of 2-benzyloxycarbonylamino-2-methyl-propionic acid (2.37 g) in tetrahydrofuran (20 mL) was added 1,1'-carbonylbis-1*H*-imidazole (1.78 g), and the mixture was stirred at room temperature for 1 hour. To the reaction mixture was added 1-methylpiperazine (2.0 mL), and the mixture was stirred at 40°C for 3.5 days. To the reaction mixture was added methanol, and the resulting mixture was concentrated under reduced pressure. The residue was purified by column chromatography on silica gel (eluent: dichloromethane/methanol = 20/1) to give 1-(2-benzyloxycarbonylamino-2-methyl-propionyl)-4-methylpiperazine (1.99 g). This material was dissolved in methanol (10 mL). To the solution was added 10% palladium-carbon powder (0.4 g), and the mixture was stirred at room temperature under a hydrogen atmosphere for 3 hours. The insoluble material was removed by filtration, and the solvent of the filtrate was removed under reduced pressure to give the title compound (1.14 g).

^{1}H−NMR (CD_3OD) δ ppm:

1.39 (6H, s), 2.3 (3H, s), 2.44 (4H, t, J=5.1Hz), 3.77 (4H, brs)

Reference Example 53

2-(2-Amino-2-methylpropionylamino)ethanol

The title compound was prepared in a similar manner to that described in Reference Example 52 using 2-aminoethanol instead of 1-methylpiperazine.

^{1}H−NMR (CD_3OD) δ ppm:

1.31 (6H, s), 3.25-3.35 (2H, m), 3.6 (2H, t, J=5.8Hz)

Example 81

3-(β-D-Glucopyranosyloxy)-5-isopropyl-4-{[4-(2-{1-[(4-methylpiperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}-ethoxy)phenyl]methyl}-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 78 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-{[4-(2-carboxyethoxy)-phenyl]methyl}-5-isopropyl-1*H*-pyrazole and 1-(2-amino-2-methylpropionyl)-4-methylpiperazine instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-{[4-(2-carboxy-ethoxy)-2-methylphenyl]methyl}-5-isopropyl-1*H*-pyrazole and 2-amino-2-methylpropionamide, respectively.

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.2 (6H, m), 1.45 (6H, s), 2.2 (3H, s), 2.3-2.5 (4H, m), 2.6 (2H, t, J=5.7Hz), 2.85-2.95 (1H, m), 3.3-3.4 (4H, m), 3.6-3.9 (8H, m), 4.18 (2H, t, J=5.7Hz), 5.05-5.1 (1H, m), 6.75-6.85 (2H,

m), 7.1-7.15 (2H, m)

Example 82

3-(β-D-Galactopyranosyloxy)-5-isopropyl-4-{[4-(2-{1-[(4-methylpiperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}-ethoxy)phenyl]methyl}-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 78 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-galactopyranosyloxy)-4-{[4-(2-carboxyethoxy)phenyl]-methyl}-5-isopropyl-1*H*-pyrazole and 1-(2-amino-2-methyl-propionyl)-4-methylpiperazine instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-{[4-(2-carboxyethoxy)-2-methylphenyl]methyl}-5-isopropyl-1*H*-pyrazole and 2-amino-2-methylpropionamide, respectively.

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.2 (6H, m), 1.45 (6H, s), 2.17 (3H, s), 2.35 (4H, brs), 2.6 (2H, t, J=5.6Hz), 2.85-2.95 (1H, m), 3.52 (1H, dd, J=9.7Hz, 3.2Hz), 3.55-3.9 (11H, m), 4.18 (2H, t, J=5.6Hz), 5.08 (1H, d, J=7.6Hz), 6.75-6.85 (2H, m), 7.05-7.2 (2H, m)

Example 83

3-(β-D-Glucopyranosyloxy)-4-[(4-{2-[1-(2-hydroxyethyl-carbamoyl)-1-(methyl)ethylcarbamoyl]ethoxy}phenyl)methyl]-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 78 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-{[4-(2-carboxyethoxy)phenyl]methyl}-

5-isopropyl-1*H*-pyrazole and 2-(2-amino-2-methylpropionyl-amino)ethanol instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-{[4-(2-carboxyethoxy)-2-methylphenyl]-methyl}-5-isopropyl-1*H*-pyrazole and 2-amino-2-methyl-propionamide, respectively.

^{1}H−NMR (CD_3OD) δ ppm:

1.1-1.15 (6H, m), 1.45 (6H, s), 2.63 (2H, t, J=6.2Hz), 2.85-2.95 (1H, m), 3.24 (2H, t, J=5.9Hz), 3.3-3.4 (4H, m), 3.51 (2H, t, J=5.9Hz), 3.6-3.85 (4H, m), 4.19 (2H, t, J=6.2Hz), 5.05-5.1 (1H, m), 6.8-6.85 (2H, m), 7.1-7.15 (2H, m)

Example 84

3-(β-D-Glucopyranosyloxy)-4-[(4-{2-[(*S*)-2-hydroxy-1-(methyl)ethylcarbamoyl]ethoxy}phenyl)methyl]-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 78 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-{[4-(2-carboxyethoxy)phenyl]-methyl}-5-isopropyl-1*H*-pyrazole and (*S*)-2-amino-1-propanol instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyl-oxy)-4-{[4-(2-carboxyethoxy)-2-methylphenyl]methyl}-5-isopropyl-1*H*-pyrazole and 2-amino-2-methylpropionamide, respectively.

^{1}H−NMR (CD_3OD) δ ppm:

1.1-1.15 (9H, m), 2.55-2.65 (2H, m), 2.85-2.95 (1H, m), 3.3-3.4 (4H, m), 3.44 (1H, dd, J=10.9Hz, 5.7Hz), 3.49 (1H, dd, J=10.9Hz, 5.6Hz), 3.6-3.75 (3H, m), 3.8-3.85 (1H, m), 3.9-4.0 (1H, m),

4.15-4.25 (2H, m), 5.0-5.1 (1H, m), 6.75-6.85 (2H, m), 7.05-7.15 (2H, m)

Example 85

3-(β-D-Glucopyranosyloxy)-5-isopropyl-4-{[4-(2-{1-[(4-methylpiperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}-ethoxy)-2-methylphenyl]methyl}-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 78 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-{2-[1-carboxy-1-(methyl)ethyl-carbamoyl]ethoxy}-2-methylphenyl)methyl]-5-isopropyl-1*H*-pyrazole and 1-methylpiperazine instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-{[4-(2-carboxyethoxy)-2-methylphenyl]methyl}-5-isopropyl-1*H*-pyrazole and 2-amino-2-methylpropionamide, respectively.

^{1}H−NMR (CD_3OD) δ ppm:

1.1-1.15 (6H, m), 1.45 (6H, s), 2.18 (3H, s), 2.29 (3H, s), 2.36 (4H, brs), 2.6 (2H, t, J=5.7Hz), 2.75-2.85 (1H, m), 3.25-3.4 (4H, m), 3.55-3.75 (7H, m), 3.82 (1H, d, J=11.8Hz), 4.17 (2H, t, J=5.7Hz), 5.0-5.15 (1H, m), 6.63 (1H, dd, J=8.4Hz, 2.5Hz), 6.71 (1H, d, J=2.5Hz), 6.87 (1H, d, J=8.4Hz)

Example 86

3-(β-D-Glucopyranosyloxy)-4-[(4-{2-[2-hydroxy-1,1-bis-(hydroxymethyl)ethylcarbamoyl]ethoxy}-2-methylphenyl)-methyl]-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to

that described in Example 78 using tris(hydroxymethyl)-aminomethane instead of 2-amino-2-methylpropionamide.

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.15 (6H, m), 2.29 (3H, s), 2.68 (2H, t, J=6.1Hz), 2.75-2.85 (1H, m), 3.25-3.4 (4H, m), 3.6-3.75 (9H, m), 3.81 (1H, d, J=12.0Hz), 4.18 (2H, t, J=6.1Hz), 5.0-5.05 (1H, m), 6.65 (1H, dd, J=8.4Hz, 2.3Hz), 6.74 (1H, d, J=2.3Hz), 6.86 (1H, d, J=8.4Hz)

Example 87

3-(β-D-Glucopyranosyloxy)-4-[(4-{2-[2-hydroxy-1,1-di-(methyl)ethylcarbamoyl]ethoxy}-2-methylphenyl)methyl]-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 78 using 2-amino-2-methyl-1-propanol instead of 2-amino-2-methylpropionamide.

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.2 (6H, m), 1.27 (6H, s), 2.29 (3H, s), 2.58 (2H, t, J=6.2Hz), 2.75-2.85 (1H, m), 3.2-3.4 (4H, m), 3.57 (2H, s), 3.6-3.75 (3H, m), 3.82 (1H, d, J=11.9Hz), 4.16 (2H, t, J=6.2Hz), 4.95-5.05 (1H, m), 6.62 (1H, dd, J=8.4Hz, 2.0Hz), 6.72 (1H, d, J=2.0Hz), 6.86 (1H, d, J=8.4Hz)

Example 88

3-(β-D-Glucopyranosyloxy)-4-[(4-{2-[2-hydroxy-1-hydroxy-methyl-1-(methyl)ethylcarbamoyl]ethoxy}-2-methylphenyl)-methyl]-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to

that described in Example 78 using 2-amino-2-methyl-1,3-propanediol instead of 2-amino-2-methylpropionamide.

^{1}H−NMR (CD_3OD) δ ppm:

1.1-1.15 (6H, m), 1.25 (3H, s), 2.29 (3H, s), 2.63 (2H, t, J=6.2Hz), 2.75-2.85 (1H, m), 3.25-3.4 (4H, m), 3.6-3.7 (7H, m), 3.81 (1H, d, J=11.8Hz), 4.17 (2H, t, J=6.2Hz), 5.0-5.05 (1H, m), 6.63 (1H, dd, J=8.4Hz, 2.4Hz), 6.73 (1H, d, J=2.4Hz), 6.86 (1H, d, J=8.4Hz)

Example 89

3-(β-D-Glucopyranosyloxy)-4-[(4-{2-[1-{[4-(2-hydroxyethyl)-piperazin-1-yl]carbonyl}-1-(methyl)ethylcarbamoyl]ethoxy}-2-methylphenyl)methyl]-5-isopropyl-1H-pyrazole

The title compound was prepared in a similar manner to that described in Example 78 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-{2-[1-carboxy-1-(methyl)ethyl-carbamoyl]ethoxy}-2-methylphenyl)methyl]-5-isopropyl-1*H*-pyrazole and 1-(2-hydroxyethyl)piperazine instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-{[4-(2-carboxyethoxy)-2-methylphenyl]methyl}-5-isopropyl-1*H*-pyrazole and 2-amino-2-methylpropionamide, respectively.

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.2 (6H, m), 1.45 (6H, s), 2.3 (3H, s), 2.35-2.55 (6H, m), 2.6 (2H, t, J=5.7Hz), 2.75-2.9 (1H, m), 3.25-3.4 (4H, m), 3.57 (2H, t, J=5.8Hz), 3.6-3.8 (7H, m), 3.82 (1H, d, J=11.9Hz), 4.17 (2H, t, J=5.7Hz), 5.0-5.05 (1H, m), 6.63 (1H, dd, J=8.4Hz, 2.4Hz), 6.71 (1H, d, J=2.4Hz), 6.87 (1H, d, J=8.4Hz)

Example 90

3-(β-D-Glucopyranosyloxy)-4-[(4-{2-[1-(2-hydroxyethyl-carbamoyl)-1-(methyl)ethylcarbamoyl]ethoxy}-2-methyl-phenyl)methyl]-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 78 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-{2-[1-carboxy-1-(methyl)ethyl-carbamoyl]ethoxy}-2-methylphenyl)methyl]-5-isopropyl-1*H*-pyrazole and 2-aminoethanol instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-{[4-(2-carboxyethoxy)-2-methylphenyl]methyl}-5-isopropyl-1*H*-pyrazole and 2-amino-2-methylpropionamide, respectively.

^{1}H−NMR (CD_3OD) δ ppm:
1.05-1.15(6H,m), 1.45(6H,s), 2.29(3H,s), 2.63(2H,t,J=6.2Hz), 2.75-2.85 (1H, m), 3.24 (2H, t, J=5.9Hz), 3.3-3.4 (4H, m), 3.51 (2H, t, J=5.9Hz), 3.6-3.7 (3H, m), 3.82 (1H, d, J=12.0Hz), 4.18 (2H,t,J=6.2Hz), 5.0-5.05(1H,m), 6.64(1H,dd,J=8.4Hz,2.4Hz), 6.74 (1H, d, J=2.4Hz), 6.86 (1H, d, J=8.4Hz)

Example 91

3-(β-D-Glucopyranosyloxy)-4-[(4-{2-[1-(3-hydroxypropyl-carbamoyl)-1-(methyl)ethylcarbamoyl]ethoxy}-2-methyl-phenyl)methyl]-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 78 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-{2-[1-carboxy-1-(methyl)ethyl-carbamoyl]ethoxy}-2-methylphenyl)methyl]-5-isopropyl-1*H*-

pyrazole and 3-amino-1-propanol instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-{[4-(2-carboxyethoxy)-2-methylphenyl]methyl}-5-isopropyl-1*H*-pyrazole and 2-amino-2-methylpropionamide, respectively.

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.15 (6H, m), 1.45 (6H, s), 1.55-1.65 (2H, m), 2.29 (3H, s), 2.62 (2H, t, J=6.1Hz), 2.75-2.85 (1H, m), 3.2 (2H, t, J=6.6Hz), 3.25-3.4 (4H, m), 3.51 (2H, t, J=6.2Hz), 3.6-3.7 (3H, m), 3.82 (1H, d, J=12.0Hz), 4.18 (2H, t, J=6.1Hz), 5.0-5.15 (1H, m), 6.64 (1H, dd, J=8.4Hz, 2.3Hz), 6.73 (1H, d, J=2.3Hz), 6.87 (1H, d, J=8.4Hz)

Example 92

4-[(4-{2-[(*S*)-1-(Carbamoyl)ethylcarbamoyl]ethoxy}-2-methylphenyl)methyl]-3-(β-D-glucopyranosyloxy)-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 78 using L-alanine amide hydrochloride instead of 2-amino-2-methylpropionamide.

^{1}H−NMR (CD_3OD) δ ppm:

1.1-1.15 (6H, m), 1.36 (3H, d, J=7.2Hz), 2.29 (3H, s), 2.6-2.85 (3H, m), 3.3-3.4 (4H, m), 3.6-3.7 (3H, m), 3.81 (1H, d, J=12.1Hz), 4.15-4.25 (2H, m), 4.36 (1H, q, J=7.2Hz), 5.0-5.05 (1H, m), 6.62 (1H, dd, J=8.4Hz, 2.5Hz), 6.72 (1H, d, J=2.5Hz), 6.86 (1H, d, J=8.4Hz)

Example 93

3-(β-D-Glucopyranosyloxy)-4-[4-{2-[(*S*)-1-(2-hydroxyethyl-carbamoyl)ethylcarbamoyl]ethoxy}-2-methylphenyl)methyl]-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 78 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-{2-[(*S*)-1-(carboxy)ethyl-carbamoyl]ethoxy}-2-methylphenyl)methyl]-5-isopropyl-1*H*-pyrazole and 2-aminoethanol instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-{[4-(2-carboxyethoxy)-2-methylphenyl]methyl}-5-isopropyl-1*H*-pyrazole and 2-amino-2-methylpropionamide, respectively.

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.15 (6H, m), 1.34 (3H, d, J=7.2Hz), 2.29 (3H, s), 2.67 (2H, t, J=6.1Hz), 2.75-2.85 (1H, m), 3.2-3.4 (6H, m), 3.55 (2H, t, J=5.8Hz), 3.6-3.7 (3H, m), 3.82 (1H, d, J=12.0Hz), 4.19 (2H, t, J=6.1Hz), 4.35 (1H, q, J=7.2Hz), 4.95-5.05 (1H, m), 6.63 (1H, dd, J=8.4Hz, 2.3Hz), 6.73 (1H, d, J=2.3Hz), 6.86 (1H, d, J=8.4Hz)

Example 94

4-[(4-{2-[(*S*)-1-Carbamoyl-2-hydroxyethylcarbamoyl]ethoxy}-2-methylphenyl)methyl]-3-(β-D-glucopyranosyloxy)-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 78 using L-serine amide hydrochloride instead of 2-amino-2-methylpropionamide.

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.2 (6H, m), 2.29 (3H, s), 2.65-2.9 (3H, m), 3.25-3.4 (4H,

m), 3.55-3.9 (6H, m), 4.21 (2H, t, J=6.0Hz), 4.4-4.5 (1H, m), 4.95-5.05 (1H, m), 6.64 (1H, dd, J=8.3Hz, 2.2Hz), 6.73 (1H, d, J=2.2Hz), 6.86 (1H, d, J=8.3Hz)

Example 95

3-(β-D-Glucopyranosyloxy)-4-[(4-{2-[2-hydroxy-1-(hydroxymethyl)ethylcarbamoyl]ethoxy}-2-methylphenyl)methyl]-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 78 using 2-amino-1,3-propanediol instead of 2-amino-2-methylpropionamide.

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.15 (6H, m), 2.29 (3H, s), 2.65 (2H, t, J=6.2Hz), 2.75-2.85 (1H, m), 3.3-3.4 (4H, m), 3.55-3.7 (7H, m), 3.86 (1H, d, J=11.6Hz), 3.9-4.0 (1H, m), 4.19 (2H, t, J=6.2Hz), 4.95-5.05 (1H, m), 6.63 (1H, dd, J=8.4Hz, 2.4Hz), 6.72 (1H, d, J=2.4Hz), 6.86 (1H, d, J=8.4Hz)

Example 96

3-(β-D-Glucopyranosyloxy)-4-[(4-{2-[(*S*)-1-(3-hydroxypropylcarbamoyl)ethylcarbamoyl]ethoxy}-2-methylphenyl)methyl]-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 78 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-{2-[(*S*)-1-(carboxy)ethylcarbamoyl]ethoxy}-2-methylphenyl)methyl]-5-isopropyl-1*H*-pyrazole and 3-amino-1-propanol instead of 3-(2,3,4,6-tetra-*O*-

acetyl-β-D-glucopyranosyloxy)-4-{[4-(2-carboxyethoxy)-2-methylphenyl]methyl}-5-isopropyl-1*H*-pyrazole and 2-amino-2-methylpropionamide, respectively.

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.15 (6H, m), 1.34 (3H, d, J=7.2Hz), 1.6-1.7 (2H, m), 2.29 (3H, s), 2.66 (2H, t, J=6.2Hz), 2.75-2.85 (1H, m), 3.2-3.4 (6H, m), 3.54 (2H, t, J=6.2Hz), 3.6-3.7 (3H, m), 3.82 (1H, d, J=11.6Hz), 4.19 (2H, t, J=6.2Hz), 4.32 (1H, q, J=7.2Hz), 5.0-5.05 (1H, m), 6.63 (1H, dd, J=8.4Hz, 2.5Hz), 6.72 (1H, d, J=2.5Hz), 6.86 (1H, d, J=8.4Hz)

Example 97

3-(β-D-Galactopyranosyloxy)-4-[(4-{4-[1-{[4-(2-hydroxyethyl)piperazin-1-yl]carbonyl}-1-(methyl)ethylcarbamoyl]butyl}phenyl)methyl]-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 78 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-galactopyranosyloxy)-4-[(4-{4-[1-carboxy-1-(methyl)ethylcarbamoyl]butyl}phenyl)methyl]-5-isopropyl-1*H*-pyrazole and 1-(2-hydroxyethyl)piperazine instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-{[4-(2-carboxyethoxy)-2-methylphenyl]methyl}-5-isopropyl-1*H*-pyrazole and 2-amino-2-methylpropionamide, respectively.

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.2 (6H, m), 1.42 (6H, s), 1.55-1.65 (4H, m), 2.18 (2H, t, J=6.8Hz), 2.4-2.65 (8H, m), 2.85-2.95 (1H, m), 3.5-3.8 (13H, m), 3.85-3.9 (1H, m), 5.08 (1H, d, J=7.8Hz), 7.04 (2H, d, J=8.0Hz),

7.1 (2H, d, J=8.0Hz)

Example 98

3-(β-D-Galactopyranosyloxy)-5-isopropyl-4-{[4-(4-{1-[(4-methylpiperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}-butyl)phenyl]methyl}-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 78 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-galactopyranosyloxy)-4-[(4-{4-[1-carboxy-1-(methyl)ethyl-carbamoyl]butyl}phenyl)methyl]-5-isopropyl-1*H*-pyrazole and 1-methylpiperazine instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-{[4-(2-carboxyethoxy)-2-methyl-phenyl]methyl}-5-isopropyl-1*H*-pyrazole and 2-amino-2-methylpropionamide, respectively.

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.15 (6H, m), 1.41 (6H, s), 1.55-1.65 (4H, m), 2.18 (2H, t, J=6.9Hz), 2.24 (3H, s), 2.35 (4H, brs), 2.57 (2H, t, J=6.6Hz), 2.85-2.95 (1H, m), 3.45-3.8 (11H, m), 3.85-3.95 (1H, m), 5.08 (1H, d, J=7.7Hz), 7.04 (2H, d, J=7.9Hz), 7.1 (2H, d, J=7.9Hz)

Example 99

3-(β-D-Glucopyranosyloxy)-5-isopropyl-4-{[4-(2-{1-[(piperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}-ethoxy)-2-methylphenyl]methyl}-1*H*-pyrazole

To a solution of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-{2-[1-carboxy-1-(methyl)ethyl-carbamoyl]ethoxy}-2-methylphenyl)methyl]-5-isopropyl-1*H*-

pyrazole (40 mg) in *N*,*N*-dimethylformamide (1 mL) were added 1-benzylpiperazine (12 mg), 1-hydroxybenzotriazole (8 mg), 1-ethyl-3-(3-dimethylaminopropyl)carbodiimide hydrochloride (16 mg) and triethylamine (0.023 mL), and the mixture was stirred at room temperature overnight. The reaction mixture was poured into water, and the resulting mixture was extracted with ethyl acetate. The extract was washed with water and brine, and dried over anhydrous sodium sulfate. The solvent was removed under reduced pressure, and the residue was purified by column chromatography on silica gel (eluent: dichloromethane/methanol = 30/1 - 15/1) to give 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-{[4-(2-{1-[(4-benzylpiperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}ethoxy)-2-methylphenyl]methyl}-5-isopropyl-1*H*-pyrazole (31 mg). This material was dissolved in methanol (3 mL). To the solution was added sodium methoxide (28% methanol solution, 0.02 mL), and the mixture was stirred at room temperature for 1 hour. To the reaction mixture was added acetic acid (0.04 mL). The resulting mixture was concentrated under reduced pressure, and the residue was purified by solid phase extraction on ODS (washing solvent: distilled water, eluent: methanol) to give 4-{[4-(2-{1-[(4-benzylpiperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}ethoxy)-2-methylphenyl]methyl}-3-(β-D-glucopyranosyloxy)-5-isopropyl-1*H*-pyrazole (24 mg). This material was dissolved in methanol (3 mL). To the solution was added 10% palladium-carbon powder (10 mg), and the mixture was stirred at room temperature under a hydrogen atmosphere overnight. The insoluble material

was removed under reduced pressure, and the solvent of the filtrate was removed under reduced pressure to give the title compound (20 mg).

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.15 (6H, m), 1.45 (6H, s), 2.3 (3H, s), 2.5-2.9 (7H, m), 3.25-3.4 (4H, m), 3.45-3.75 (7H, m), 3.81 (1H, d, J=11.5Hz), 4.17 (2H, t, J=5.7Hz), 4.95-5.05 (1H, m), 6.62 (1H, dd, J=8.4Hz, 2.5Hz), 6.71 (1H, d, J=2.5Hz), 6.86 (1H, d, J=8.4Hz)

Example 100

3-(β-D-Galactopyranosyloxy)-5-isopropyl-4-{[4-(4-{1-[(piperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}butyl)-phenyl]methyl}-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 99 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-galactopyranosyloxy)-4-[(4-{4-[1-carboxy-1-(methyl)ethyl-carbamoyl]butyl}phenyl)methyl]-5-isopropyl-1*H*-pyrazole instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyl-oxy)-4-[(4-{2-[1-carboxy-1-(methyl)ethylcarbamoyl]ethoxy}-2-methylphenyl)methyl]-5-isopropyl-1*H*-pyrazole.

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.15 (6H, m), 1.41 (6H, s), 1.5-1.65 (4H, m), 2.17 (2H, t, J=7.1Hz), 2.58 (2H, t, J=6.8Hz), 2.72 (4H, brs), 2.85-2.95 (1H,m), 3.45-3.8 (11H,m), 3.8-3.9 (1H,m), 5.08 (1H,d,J=7.7Hz), 7.04 (2H, d, J=8.0Hz), 7.1 (2H, d, J=8.0Hz)

Example 101

4-[(4-{2-[(*S*)-5-Amino-1-(carbamoyl)pentylcarbamoyl]ethoxy}-2-methylphenyl)methyl]-3-(β-D-glucopyranosyloxy)-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 99 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-{[4-(2-carboxyethoxy)-2-methyl-phenyl]methyl}-5-isopropyl-1*H*-pyrazole and (*S*)-2-amino-6-(benzyloxycarbonylamino)hexanamide hydrochloride instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-{2-[1-carboxy-1-(methyl)ethylcarbamoyl]ethoxy}-2-methyl-phenyl)methyl]-5-isopropyl-1*H*-pyrazole and 1-benzyl-piperazine, respectively.

^{1}H—NMR (CD_3OD) δ ppm:

1.1-1.2 (6H, m), 1.3-1.95 (6H, m), 2.3 (3H, s), 2.6-2.9 (5H, m), 3.3-3.4 (4H, m), 3.6-3.7 (3H, m), 3.82 (1H, d, J=11.8Hz), 4.15-4.25 (2H, m), 4.38 (1H, dd, J=9.3Hz, 4.8Hz), 5.0-5.05 (1H, m), 6.62 (1H, dd, J=8.4Hz, 2.5Hz), 6.72 (1H, d, J=2.5Hz), 6.86 (1H, d, J=8.4Hz)

Example 102

4-[(4-{2-[(*S*)-5-Amino-5-(carbamoyl)pentylcarbamoyl]ethoxy}-2-methylphenyl)methyl]-3-(β-D-glucopyranosyloxy)-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 99 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-{[4-(2-carboxyethoxy)-2-methyl-phenyl]methyl}-5-isopropyl-1*H*-pyrazole and (*S*)-6-amino-2-

(benzyloxycarbonylamino)hexanamide hydrochloride instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-{2-[1-carboxy-1-(methyl)ethylcarbamoyl]ethoxy}-2-methylphenyl)methyl]-5-isopropyl-1*H*-pyrazole and 1-benzylpiperazine, respectively.

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.15 (6H, m), 1.3-1.8 (6H, m), 2.29 (3H, s), 2.59 (2H, t, J=6.1Hz), 2.75-2.85 (1H, m), 3.21 (2H, t, J=6.9Hz), 3.3-3.4 (5H, m), 3.6-3.7 (3H, m), 3.81 (1H, d, J=11.5Hz), 4.18 (2H, t, J=6.1Hz), 5.0-5.05 (1H, m), 6.62 (1H, dd, J=8.4Hz, 2.4Hz), 6.71 (1H, d, J=2.4Hz), 6.86 (1H, d, J=8.4Hz)

Example 103

3-(β-D-Glucopyranosyloxy)-5-isopropyl-4-{[4-(3-{1-[(piperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}-propyl)-2-methylphenyl]methyl}-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 99 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-{3-[1-carboxy-1-(methyl)ethylcarbamoyl]propyl}-2-methylphenyl)methyl]-5-isopropyl-1*H*-pyrazole and 1-(benzyloxycarbonyl)piperazine instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-{2-[1-carboxy-1-(methyl)ethylcarbamoyl]ethoxy}-2-methylphenyl)methyl]-5-isopropyl-1*H*-pyrazole and 1-benzylpiperazine, respectively.

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.2 (6H, m), 1.42 (6H, s), 1.8-1.95 (2H, m), 2.16 (2H, t,

J=7.2Hz), 2.3 (3H, s), 2.55 (2H, t, J=7.5Hz), 2.65-2.9 (5H, m), 3.2-3.45 (4H, m), 3.5-3.9 (8H, m), 4.95-5.05 (1H, m), 6.8-6.9 (2H, m), 6.9-7.0 (1H, m)

Example 104

4-{[4-(3-{1-[(*S*)-5-Amino-5-(carbamoyl)pentylcarbamoyl]-1-(methyl)ethylcarbamoyl}propyl)phenyl]methyl}-3-(β-D-galactopyranosyloxy)-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 99 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-galactopyranosyloxy)-4-[(4-{3-[1-carboxy-1-(methyl)ethylcarbamoyl]propyl}phenyl)methyl]-5-isopropyl-1*H*-pyrazole and (*S*)-6-amino-2-(benzyloxycarbonylamino)hexanamide hydrochloride instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-{2-[1-carboxy-1-(methyl)ethylcarbamoyl]ethoxy}-2-methylphenyl)methyl]-5-isopropyl-1*H*-pyrazole and 1-benzylpiperazine, respectively.

^{1}H−NMR (CD_3OD) δ ppm:

1.1-1.2 (6H, m), 1.2-1.6 (11H, m), 1.6-1.75 (1H, m), 1.8-1.9 (2H, m), 2.19 (2H, t, J=7.8Hz), 2.58 (2H, t, J=7.7Hz), 2.85-2.95 (1H, m), 3.1-3.25 (2H, m), 3.25-3.35 (1H, m), 3.52 (1H, dd, J=9.7Hz, 3.4Hz), 3.55-3.65 (1H, m), 3.65-3.8 (5H, m), 3.86 (1H, d, J=3.1Hz), 5.08 (1H, d, J=8.0Hz), 7.0-7.15 (4H, m)

Example 105

3-(β-D-Glucopyranosyloxy)-5-isopropyl-4-{[4-(3-{1-[(piperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}-

propoxy)-2-methylphenyl]methyl}-1*H*-pyrazole

To a solution of 4-[(4-{3-[1-carboxy-1-(methyl)ethyl-carbamoyl]propoxy}-2-methylphenyl)methyl]-5-isopropyl-3-(2,3,4,6-tetra-*O*-pivaloyl-β-D-glucopyranosyloxy)-1*H*-pyrazole (0.12 g) in *N*,*N*-dimethylformamide (3 mL) were added 1-(benzyloxycarbonyl)piperazine (43 mg), 1-hydroxybenzotriazole (19 mg), 1-ethyl-3-(3-dimethylaminopropyl)-carbodiimide hydrochloride (50 mg) and triethylamine (0.027 mL), and the mixture was stirred at room temperature overnight. The reaction mixture was poured into water. The precipitated crystals were collected by filtration, and washed with water and dried under reduced pressure to give 4-[(4-{3-[1-{[4-(benzyloxycarbonyl)piperazin-1-yl]carbonyl}-1-(methyl)-ethylcarbamoyl]propoxy}-2-methylphenyl)methyl]-5-isopropyl-3-(2,3,4,6-tetra-*O*-pivaloyl-β-D-glucopyranosyloxy)-1*H*-pyrazole (0.14 g). This material was dissolved in ethanol (4 mL). To the solution was added 10% palladium-carbon powder (30 mg), and the mixture was stirred at room temperature under a hydrogen atmosphere for 1.5 hours. The insoluble material was removed by filtration, and the solvent of the filtrate was removed under reduced pressure. The residue was purified by column chromatography on silica gel (eluent: dichloromethane/methanol = 10/1 - 5/1) to give 5-isopropyl-4-{[4-(3-{1-[(piperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}propoxy)-2-methyl-phenyl]methyl}-3-(2,3,4,6-tetra-*O*-pivaloyl-β-D-gluco-pyranosyloxy)-1*H*-pyrazole (89 mg). This material was dissolved in methanol (6 mL). To the solution was added sodium methoxide

(28% methanol solution, 0.087 mL), and the mixture was stirred at 50°C for 3 hours. The reaction mixture was concentrated under reduced pressure, and the residue was purified by solid phase extraction on ODS (washing solvent: distilled water, eluent: methanol) to give the title compound (54 mg).

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.15 (6H, m), 1.42 (6H, s), 1.95-2.05 (2H, m), 2.29 (3H, s), 2.39 (2H, t, J=7.3Hz), 2.55-2.9 (5H, m), 3.25-3.4 (4H, m), 3.5-3.7 (7H, m), 3.75-3.85 (1H, m), 3.95 (2H, t, J=6.0Hz), 5.0-5.05 (1H, m), 6.61 (1H, dd, J=8.4Hz, 2.3Hz), 6.71 (1H, d, J=2.3Hz), 6.84 (1H, d, J=8.4Hz)

Example 106

3-(β-D-Glucopyranosyloxy)-4-[(4-{3-[1-{[4-(2-hydroxyethyl)-piperazin-1-yl]carbonyl}-1-(methyl)ethylcarbamoyl]propoxy}-2-methylphenyl)methyl]-5-isopropyl-1*H*-pyrazole

To a solution of 4-[(4-{3-[1-carboxy-1-(methyl)ethyl-carbamoyl]propoxy}-2-methylphenyl)methyl]-5-isopropyl-3-(2,3,4,6-tetra-*O*-pivaloyl-β-D-glucopyranosyloxy)-1*H*-pyrazole (40 mg) in *N*,*N*-dimethylformamide (2 mL) were added 1-(2-hydroxyethyl)piperazine (7 mg), 1-hydroxybenzotriazole (7 mg), 1-ethyl-3-(3-dimethylaminopropyl)carbodiimide hydrochloride (13 mg) and triethylamine (0.018 mL), and the mixture was stirred at room temperature overnight. The reaction mixture was poured into water, and the resulting mixture was extracted with ethyl acetate. The extract was washed with water and brine, and dried over anhydrous sodium sulfate. The solvent

was removed under reduced pressure, and the residue was purified by column chromatography on silica gel (eluent: dichloromethane/methanol = 15/1) to give 4-[(4-{3-[1-{[4-(2-hydroxyethyl)piperazin-1-yl]carbonyl}-1-(methyl)ethylcarbamoyl]propoxy}-2-methylphenyl)methyl]-5-isopropyl-3-(2,3,4,6-tetra-*O*-pivaloyl-β-D-glucopyranosyloxy)-1*H*-pyrazole (27 mg). This material was dissolved in methanol (2 mL). To the solution was added sodium methoxide (28% methanol solution, 0.015 mL), and the mixture was stirred at 50°C overnight. The reaction mixture was concentrated under reduced pressure, and the residue was purified by solid phase extraction on ODS (washing solvent: distilled water, eluent: methanol) to give the title compound (12 mg).

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.15 (6H, m), 1.42 (6H, s), 1.95-2.05 (2H, m), 2.29 (3H, s), 2.35-2.5 (8H, m), 2.75-2.85 (1H, m), 3.25-3.4 (4H, m), 3.55-3.75 (9H, m), 3.75-3.85 (1H, m), 3.94 (2H, t, J=6.1Hz), 5.0-5.05 (1H, m), 6.61 (1H, dd, J=8.4Hz, 2.4Hz), 6.7 (1H, d, J=2.4Hz), 6.85 (1H, d, J=8.4Hz)

Example 107

<u>3-(β-D-Glucopyranosyloxy)-5-isopropyl-4-{[4-(3-{1-[(4-methylpiperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}-propoxy)-2-methylphenyl]methyl}-1*H*-pyrazole</u>

The title compound was prepared in a similar manner to that described in Example 106 using 1-methylpiperazine instead of 1-(2-hydroxyethyl)piperazine.

^{1}H—NMR (CD_3OD) δ ppm:

1.05-1.15 (6H, m), 1.42 (6H, s), 1.95-2.05 (2H, m), 2.22 (3H, s), 2.25-2.45 (9H, m), 2.75-2.85 (1H, m), 3.25-3.4 (4H, m), 3.55-3.75 (7H, m), 3.75-3.85 (1H, m), 3.95 (2H, t, J=6.0Hz), 5.03 (1H, d, J=7.5Hz), 6.61 (1H, dd, J=8.3Hz, 2.6Hz), 6.7 (1H, d, J=2.6Hz), 6.85 (1H, d, J=8.3Hz)

Example 108

3-(β-D-Glucopyranosyloxy)-4-[(4-{3-[1-(2-hydroxyethyl-carbamoyl)-1-(methyl)ethylcarbamoyl]propoxy}-2-methyl-phenyl)methyl]-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 106 using 2-aminoethanol instead of 1-(2-hydroxyethyl)piperazine.

^{1}H—NMR (CD_3OD) δ ppm:

1.05-1.15 (6H, m), 1.42 (6H, s), 1.95-2.05 (2H, m), 2.28 (3H, s), 2.39 (2H, t, J=7.4Hz), 2.75-2.85 (1H, m), 3.2-3.4 (6H, m), 3.56 (2H, t, J=5.9Hz), 3.6-3.7 (3H, m), 3.75-3.85 (1H, m), 3.94 (2H, t, J=6.1Hz), 4.95-5.05 (1H, m), 6.61 (1H, dd, J=8.4Hz, 2.3Hz), 6.71 (1H, d, J=2.3Hz), 6.85 (1H, d, J=8.4Hz)

Reference Example 54

1-(3-Benzoyloxypropyl)-1,2-dihydro-4-[(4-iodophenyl)-methyl]-5-isopropyl-3*H*-pyrazol-3-one

To a solution of 1,2-dihydro-4-[(4-iodophenyl)-methyl]-5-isopropyl-3*H*-pyrazol-3-one (5 g) and imidazole (1.19 g) in *N*,*N*-dimethylformamide (20 mL) was added triisopropylsilyl

chloride (3.1 g) at room temperature, and the mixture was stirred for 3 hours. The reaction mixture was poured into water, and the resulting mixture was extracted with ethyl acetate. The extract was washed with water and brine, and dried over anhydrous sodium sulfate. The solvent was removed under reduced pressure to give 4-[(4-iodophenyl)methyl]-5-isopropyl-3-triisopropylsilyloxy-1*H*-pyrazole (7.27 g). To a solution of obtained 4-[(4-iodophenyl)methyl]-5-isopropyl-3-triisopropylsilyloxy-1*H*-pyrazole (3 g) in *N*,*N*-dimethylformamide (10 mL) was added sodium hydride (55%, 0.33 g) under ice-cooling, and the mixture was stirred for 20 minutes. To the reaction mixture were added a solution of 1-benzoyloxy-3-chloropropane (3.0 g) in *N*,*N*-dimethylformamide (10 mL) and potassium iodide (0.25 g) at the same temperature, and the resulting mixture was stirred at room temperature overnight. The reaction mixture was poured into water, and the mixture was extracted with ethyl acetate. The extract was washed with water and brine, and dried over anhydrous sodium sulfate. The solvent was removed under reduced pressure, and the residue was purified by column chromatography on silica gel (eluent: *n*-hexane/ethyl acetate = 20/1 - 10/1) to give 1-(3-benzoyloxypropyl)-4-[(4-iodophenyl)methyl]-5-isopropyl-3-triisopropylsilyloxy-1*H*-pyrazole (2.55 g). This material was dissolved in tetrahydrofuran (3 mL). To the solution was added 4 mol/L hydrochloric acid (1,4-dioxane solution, 10 mL), and the mixture was stirred at room temperature overnight. The reaction mixture was diluted with ethyl acetate, and the resulting mixture was poured into water. The organic

layer was separated, and the organic layer was washed with brine, and dried over anhydrous sodium sulfate. The solvent was removed under reduced pressure. To the residue was added a mixed solvent of *n*-hexane and ethyl acetate (20/1) (10 mL), and the mixture was stirred at room temperature for 1 hour. The precipitated crystals were collected by filtration, and washed with a mixed solvent of *n*-hexane and ethyl acetate (20/1) and dried under reduced pressure to give the title compound (0.85 g).

^{1}H−NMR (DMSO-d_6) δ ppm:

1.06 (6H, d, J=7.3Hz), 2.1-2.2 (2H, m), 2.95-3.1 (1H, m), 3.6 (2H, s), 4.02 (2H, t, J=6.9Hz), 4.27 (2H, t, J=6.1Hz), 6.94 (2H, d, J=8.3Hz), 7.5-7.7 (5H, m), 7.9-8.0 (2H, m), 9.51 (1H, s)

Reference Example 55

Benzyl 2-amino-2-methylpropionate

Benzyl 2-amino-2-methylpropionate hydrochloride (1.48 g) was dissolved in ethyl acetate (60 mL) and a saturated aqueous sodium hydrogen carbonate solution (20 mL), and the organic layer was separated. The organic layer was washed with brine, and dried over anhydrous magnesium sulfate. The solvent was removed under reduced pressure to give the title compound (1.2 g).

^{1}H−NMR ($CDCl_3$) δ ppm:

1.37 (6H, s), 5.14 (2H, s), 7.3-7.45 (5H, m)

Reference Example 56

3-(2,3,4,6-Tetra-*O*-acetyl-β-D-galactopyranosyloxy)-1-(3-benzoyloxypropyl)-4-[(4-{3-[1-carboxy-1-(methyl)ethyl-

carbamoyl]propyl}phenyl)methyl]-5-isopropyl-1*H*-pyrazole

To a mixture of 1-(3-benzoyloxypropyl)-1,2-dihydro-4-[(4-iodophenyl)methyl]-5-isopropyl-3*H*-pyrazol-3-one (0.85 g), acetobromo-α-D-galactose (0.91 g) and benzyltri(*n*-butyl)-ammonium chloride (0.53 g) in dichloromethane (2.55 mL) was added 5 mol/L aqueous sodium hydroxide solution (0.85 mL), and the mixture was stirred at room temperature for 6 hours. The reaction mixture was diluted with dichloromethane, and the mixture was poured into water. The organic layer was separated, and washed with brine and dried over anhydrous sodium sulfate. The solvent was removed under reduced pressure. To a solution of the residue in acetonitrile (2.5 mL) were added 3-butenoic acid (0.36 g), triethylamine (1.71 g), palladium acetate (II) (38 mg) and tris(2-methylphenyl)phosphine (0.1 g), and the mixture was refluxed for 3 hours. The solvent was removed under reduced pressure, and the residue was dissolved in ethyl acetate. The solution was washed with water. The aqueous layer was extracted with ethyl acetate. The combined organic layers were washed with water and brine, and dried over anhydrous sodium sulfate. The solvent was removed under reduced pressure, and the residue was dissolved in tetrahydrofuran (5 mL). To the solution were added benzyl 2-amino-2-methylpropionate (1.63 g), 1-hydroxybenzotriazole (0.46 g) and 1-ethyl-3-(3-dimethyl-aminopropyl)carbodiimide hydrochloride (0.65 g), and the mixture was stirred at room temperature for 2 days. The reaction mixture was poured into water, and the resulting mixture was extracted with ethyl acetate. The extract was washed with water

and brine, and dried over anhydrous sodium sulfate. The solvent was removed under reduced pressure, and the residue was purified by column chromatography on silica gel (eluent: *n*-hexane/ethyl acetate = 1/1) to give 3-(2,3,4,6-tetra-*O*-acetyl-β-D-galacto-pyranosyloxy)-1-(3-benzoyloxypropyl)-4-[(4-{(1*E*)-3-[1-carboxy-1-(methyl)ethylcarbamoyl]prop-1-enyl}phenyl)-methyl]-5-isopropyl-1*H*-pyrazole (0.55 g). This material was dissolved in methanol (5 mL). To the solution was added 10% palladium-carbon powder (0.15 g), and the mixture was stirred at room temperature under a hydrogen atmosphere for 3 hours. The insoluble material was removed by filtration, and the solvent of the filtrate was removed under reduced pressure to give the title compound (0.48 g).

^{1}H−NMR ($CDCl_3$) δ ppm:

1.1-1.2 (6H, m), 1.53 (3H, s), 1.54 (3H, s), 1.85-2.2 (16H, m), 2.25-2.35 (2H, m), 2.61 (2H, t, J=7.1Hz), 2.95-3.05 (1H, m), 3.67 (1H, d, J=16.7Hz), 3.71 (1H, d, J=16.7Hz), 3.95-4.05 (1H, m), 4.05-4.2 (4H, m), 4.36 (2H, t, J=5.7Hz), 5.0-5.1 (1H, m), 5.3-5.45 (2H, m), 5.51 (1H, d, J=8.2Hz), 6.19 (1H, s), 6.95-7.05 (4H, m), 7.4-7.5 (2H, m), 7.5-7.6 (1H, m), 8.0-8.1 (2H, m)

Example 109

3-(β-D-Galactopyranosyloxy)-1-(3-hydroxypropyl)-5-isopropyl-4-{[4-(3-{1-[(piperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}propyl)phenyl]methyl}-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 99 using 3-(2,3,4,6-tetra-*O*-acetyl-β-

D-galactopyranosyloxy)-1-(3-benzoyloxypropyl)-4-[(4-{3-[1-carboxy-1-(methyl)ethylcarbamoyl]propyl}phenyl)methyl]-5-isopropyl-1*H*-pyrazole and 1-(benzyloxycarbonyl)piperazine instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-{2-[1-carboxy-1-(methyl)ethylcarbamoyl]ethoxy}-2-methylphenyl)methyl]-5-isopropyl-1*H*-pyrazole and 1-benzyl-piperazine, respectively.

^{1}H—NMR (CD_3OD) δ ppm:

1.1-1.2 (6H, m), 1.42 (6H, s), 1.8-2.0 (4H, m), 2.17 (2H, t, J=7.7Hz), 2.58 (2H, t, J=7.4Hz), 2.65-2.8 (4H, m), 3.05-3.2 (1H, m), 3.45-3.9 (14H, m), 4.08 (2H, t, J=7.0Hz), 5.11 (1H, d, J=7.8Hz), 7.0-7.15 (4H, m)

Example 110

3-(2,3,4,6-Tetra-*O*-acetyl-β-D-galactopyranosyloxy)-4-[(4-{3-[1-{[4-(benzyloxycarbonyl)piperazin-1-yl]carbonyl}-1-(methyl)ethylcarbamoyl]propyl}phenyl)methyl]-5-isopropyl-1*H*-pyrazole

3-(2,3,4,6-Tetra-*O*-acetyl-β-D-galactopyranosyloxy)-4-[(4-{3-[1-carboxy-1-(methyl)ethylcarbamoyl]propyl}phenyl)-methyl]-5-isopropyl-1*H*-pyrazole (37 g) was dissolved in *N*,*N*-dimethylformamide (180 mL). To the solution were added 1-(benzyloxycarbonyl)piperazine (28.4 g), 1-hydroxybenzo-triazole (10.5 g) and 1-ethyl-3-(3-dimethylaminopropyl)-carbodiimide hydrochloride (14.8 g), and the mixture was stirred at room temperature overnight. The reaction mixture was poured into water, and the resulting mixture was extracted with ethyl

acetate twice. The extracts were washed with water and brine, and dried over anhydrous sodium sulfate. The solvent was removed under reduced pressure, and the residue was purified by column chromatography on silica gel (eluent: *n*-hexane/ethyl acetate = 1/2 - ethyl acetate) to give the title compound (40.5 g).

^{1}H−NMR ($CDCl_3$) δ ppm:

1.1-1.2 (6H, m), 1.56 (6H, s), 1.85-1.95 (5H, m), 1.98 (3H, s), 2.02 (3H, s), 2.12 (2H, t, J=7.5Hz), 2.16 (3H, s), 2.58 (2H, t, J=7.5Hz), 2.85-2.95 (1H, m), 3.4-3.55 (4H, m), 3.55-3.75 (6H, m), 4.0-4.1 (1H, m), 4.1-4.2 (2H, m), 5.09 (1H, dd, J=10.6Hz, 3.3Hz), 5.14 (2H, s), 5.35-5.45 (2H, m), 5.56 (1H, d, J=7.8Hz), 6.39 (1H, s), 6.95-7.1 (4H, m), 7.3-7.4 (5H, m)

Example 111

4-[(4-{3-[1-{[4-(Benzyloxycarbonyl)piperazin-1-yl]-carbonyl}-1-(methyl)ethylcarbamoyl]propyl}phenyl)methyl]-3-(β-D-galactopyranosyloxy)-5-isopropyl-1*H*-pyrazole

To a solution of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-galacto-pyranosyloxy)-4-[(4-{3-[1-{[4-(benzyloxycarbonyl)piperazin-1-yl]carbonyl}-1-(methyl)ethylcarbamoyl]propyl}phenyl)-methyl]-5-isopropyl-1*H*-pyrazole (39.5 g) in methanol (160 mL) was added sodium methoxide (28% methanol solution, 8.24 mL), and the mixture was stirred at room temperature overnight. To the reaction mixture was added acetic acid (2.7 mL), and the resulting mixture was concentrated under reduced pressure. The residue was purified by column chromatography on silica gel (eluent: dichloromethane/methanol = 10/1) to give the title

compound (21.3 g).

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.15 (6H, m), 1.42 (6H, s), 1.8-1.9 (2H, m), 2.16 (2H, t, J=7.8Hz), 2.57 (2H, t, J=7.6Hz), 2.8-2.95 (1H, m), 3.35-3.8 (15H, m), 3.85-3.9 (1H, m), 5.07 (1H, d, J=7.9Hz), 5.12 (2H, s), 7.04 (2H, d, J=8.2Hz), 7.11 (2H, d, J=8.2Hz), 7.25-7.4 (5H, m)

Reference Example 57

[4-Benzyloxy-2-(tetrahydro-4*H*-pyran-4-yloxy)phenyl]methanol

To a solution of tetrahydro-4*H*-pyran-4-ol (3.62 g) and triethylamine (5.6 mL) in tetrahydrofuran (35 mL) was added methanesulfonyl chloride (2.93 mL) under ice-cooling, and the mixture was stirred at room temperature for 1 hour. The insoluble material was removed by filtration. To the filtrate were added *N*,*N*-dimethylformamide (70 mL), 4-benzyloxy-2-hydroxybenzaldehyde (5.39 g) and cesium carbonate (23 g), and the mixture was stirred at 80°C for 12 hours. The reaction mixture was poured into water, and the resulting mixture was extracted with diethyl ether. The extract was washed with water and brine, and dried over anhydrous magnesium sulfate. The solvent was removed under reduced pressure, and the residue was purified by column chromatography on silica gel (eluent: *n*-hexane/ethyl acetate = 4/1 - 2/1) to give 4-benzyloxy-2-(tetrahydro-4*H*-pyran-4-yloxy)benzaldehyde (4.58 g). This material was dissolved in ethanol (70 mL). To the solution was added sodium borohydride (0.28 g) under ice-cooling, and the mixture was stirred at room temperature for 3 hours. To the reaction mixture was added

methanol, and the resulting mixture was concentrated under reduced pressure. A saturated aqueous sodium hydrogen carbonate solution was added to the residue, and the mixture was extracted with diethyl ether. The extract was washed with a saturated aqueous sodium hydrogen carbonate solution, water and brine successively, and dried over anhydrous magnesium sulfate. The solvent was removed under reduced pressure, and the residue was purified by column chromatography on silica gel (eluent: *n*-hexane/ethyl acetate = 3/1 - 1/1) to give the title compound (4.45 g).

^{1}H−NMR ($CDCl_3$) δ ppm:

1.75-1.85 (2H, m), 1.95-2.05 (2H, m), 2.11 (1H, t, J=6.3Hz), 3.5-3.65 (2H, m), 3.9-4.0 (2H, m), 4.45-4.55 (1H, m), 4.63 (2H, d, J=6.3Hz), 5.05 (2H, s), 6.5-6.6 (2H, m), 7.19 (1H, d, J=7.7Hz), 7.3-7.45 (5H, m)

Reference Example 58

4-{[4-Benzyloxy-2-(tetrahydro-4*H*-pyran-4-yloxy)phenyl]-methyl}-1,2-dihydro-5-isopropyl-3*H*-pyrazol-3-one

To a solution of [4-benzyloxy-2-(tetrahydro-4*H*-pyran-4-yloxy)phenyl]methanol (4.45 g) in tetrahydrofuran (28 mL) were added triethylamine (2.27 mL) and methanesulfonyl chloride (1.21 mL) under ice-cooling, and the mixture was stirred for 1 hour. The insoluble material was removed by filtration. The obtained solution of [4-benzyloxy-2-(tetrahydro-4*H*-pyran-4-yloxy)-phenyl]methyl mesylate in tetrahydrofuran was added to a suspension of sodium hydride (55%, 710 mg) and methyl

4-methyl-3-oxopentanoate (2.25 g) in tetrahydrofuran (56 mL), and the mixture was heated for reflux for 8 hours. To the reaction mixture was added 1 mol/L hydrochloric acid, and the resulting mixture was extracted with diethyl ether. The organic layer was washed with water, and dried over anhydrous magnesium sulfate. The solvent was removed under reduced pressure. To a solution of the residue in toluene (8 mL) was added hydrazine monohydrate (3.43 mL), and the mixture was stirred at 100°C for 8 hours. The reaction mixture was purified by column chromatography on silica gel (eluent: dichloromethane/methanol = 20/1 - 10/1) to give the title compound (1.69 g).

^{1}H−NMR ($CDCl_3$) δ ppm:

1.16 (6H, d, J=7.1Hz), 1.75-1.9 (2H, m), 1.95-2.1 (2H, m), 2.9-3.05 (1H, m), 3.5-3.6 (2H, m), 3.64 (2H, s), 3.9-4.05 (2H, m), 4.4-4.5 (1H, m), 5.0 (2H, s), 6.45-6.55 (2H, m), 7.0 (1H, d, J=8.4Hz), 7.25-7.45 (5H, m)

Reference example 59

3-(2,3,4,6-Tetra-*O*-acetyl-β-D-galactopyranosyloxy)-4-[(4-benzyloxy-2-methylphenyl)methyl]-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Reference Example 12 using 4-[(4-benzyloxy-2-methylphenyl)methyl]-1,2-dihydro-5-isopropyl-3*H*-pyrazol-3-one and acetobromo-α-D-galactose instead of 4-{[4-(2-benzyloxycarbonyl-2-methylpropoxy)phenyl]methyl}-1,2-dihydro-5-isopropyl-3*H*-pyrazol-3-one and acetobromo-α-D-glucose, respectively.

^{1}H−NMR ($CDCl_3$) δ ppm:

1.05-1.2 (6H, m), 1.78 (3H, s), 1.98 (3H, s), 2.03 (3H, s), 2.16 (3H, s), 2.28 (3H, s), 2.75-2.85 (1H, m), 3.51 (1H, d, J=16.4Hz), 3.62 (1H, d, J=16.4Hz), 4.0-4.1 (1H, m), 4.1-4.2 (2H, m), 5.02 (2H, s), 5.07 (1H, dd, J=10.4Hz, 3.5Hz), 5.35-5.45 (2H, m), 5.51 (1H, d, J=7.9Hz), 6.66 (1H, dd, J=8.3Hz, 2.8Hz), 6.75-6.85 (2H, m), 7.2-7.45 (5H, m)

Reference Example 60

4-{[4-Benzyloxy-2-(tetrahydro-4*H*-pyran-4-yloxy)phenyl]-methyl}-5-isopropyl-3-(2,3,4,6-tetra-*O*-pivaloyl-β-D-glucopyranosyloxy)-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Reference Example 12 using 4-{[4-benzyloxy-2-(tetrahydro-4*H*-pyran-4-yloxy)phenyl]methyl}-1,2-dihydro-5-isopropyl-3*H*-pyrazol-3-one and 2,3,4,6-tetra-*O*-pivaloyl-α-D-glucopyranosyl bromide instead of 4-{[4-(2-benzyloxy-carbonyl-2-methylpropoxy)phenyl]methyl}-1,2-dihydro-5-isopropyl-3*H*-pyrazol-3-one and acetobromo-α-D-glucose, respectively.

^{1}H−NMR ($CDCl_3$) δ ppm:

1.0-1.2 (42H, m), 1.7-1.85 (2H, m), 1.95-2.05 (2H, m), 2.85-2.95 (1H, m), 3.5-3.65 (4H, m), 3.8-3.9 (1H, m), 3.9-4.0 (2H, m), 4.12 (1H, dd, J=12.4Hz, 5.1Hz), 4.19 (1H, dd, J=12.4Hz, 1.8Hz), 4.4-4.5 (1H, m), 4.99 (2H, s), 5.15-5.3 (2H, m), 5.36 (1H, t, J=9.4Hz), 5.66 (1H, d, J=8.0Hz), 6.42 (1H, dd, J=8.3Hz, 2.3Hz), 6.47 (1H, d, J=2.3Hz), 6.86 (1H, d, J=8.3Hz), 7.25-7.45 (5H,

m)

Reference Example 61

3-(2,3,4,6-Tetra-*O*-acetyl-β-D-galactopyranosyloxy)-4-[(4-hydroxy-2-methylphenyl)methyl]-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Reference Example 25 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-galactopyranosyloxy)-4-[(4-benzyloxy-2-methylphenyl)methyl]-5-isopropyl-1*H*-pyrazole instead of 4-[(4-benzyloxy-2-methylphenyl)methyl]-5-isopropyl-3-(2,3,4,6-tetra-*O*-pivaloyl-β-D-glucopyranosyloxy)-1*H*-pyrazole.

^{1}H−NMR ($CDCl_3$) δ ppm:

1.1-1.2 (6H, m), 1.83 (3H, s), 1.98 (3H, s), 2.03 (3H, s), 2.16 (3H, s), 2.25 (3H, s), 2.75-2.9 (1H, m), 3.5 (1H, d, J=16.6Hz), 3.6 (1H, d, J=16.6Hz), 4.0-4.05 (1H, m), 4.1-4.2 (2H, m), 4.78 (1H, brs), 5.06 (1H, dd, J=10.4Hz, 3.5Hz), 5.35-5.45 (2H, m), 5.5 (1H, d, J=8.2Hz), 6.52 (1H, dd, J=8.1Hz, 2.6Hz), 6.62 (1H, d, J=2.6Hz), 6.76 (1H, d, J=8.1Hz)

Reference Example 62

4-{[4-Hydroxy-2-(tetrahydro-4*H*-pyran-4-yloxy)phenyl]-methyl}-5-isopropyl-3-(2,3,4,6-tetra-*O*-pivaloyl-β-D-gluco-pyranosyloxy)-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Reference Example 25 using 4-{[4-benzyloxy-2-(tetrahydro-4*H*-pyran-4-yloxy)phenyl]methyl}-5-isopropyl-3-(2,3,4,6-tetra-*O*-pivaloyl-β-D-glucopyranosyloxy)-1*H*-

pyrazole instead of 4-[(4-benzyloxy-2-methylphenyl)methyl]-5-isopropyl-3-(2,3,4,6-tetra-*O*-pivaloyl-β-D-glucopyranosyl-oxy)-1*H*-pyrazole.

^{1}H—NMR ($CDCl_3$) δ ppm:

1.0-1.2 (42H, m), 1.75-1.9 (2H, m), 1.95-2.1 (2H, m), 2.8-2.95 (1H, m), 3.52 (1H, d, J=16.5Hz), 3.55-3.65 (3H, m), 3.8-3.9 (1H, m), 3.9-4.05 (2H, m), 4.05-4.2 (2H, m), 4.4-4.5 (1H, m), 5.14 (1H, brs), 5.15-5.3 (2H, m), 5.3-5.4 (1H, m), 5.65 (1H, d, J=8.1Hz), 6.22 (1H, dd, J=8.2Hz, 2.3Hz), 6.37 (1H, d, J=2.3Hz), 6.78 (1H, d, J=8.2Hz)

Reference Example 63

3-(2,3,4,6-Tetra-*O*-acetyl-β-D-galactopyranosyloxy)-4-({4-[3-(benzyloxycarbonyl)propoxy]-2-methylphenyl}methyl)-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Reference Example 27 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-galactopyranosyloxy)-4-[(4-hydroxy-2-methylphenyl)methyl]-5-isopropyl-1*H*-pyrazole instead of 4-[(4-hydroxy-2-methylphenyl)methyl]-5-isopropyl-3-(2,3,4,6-tetra-*O*-pivaloyl-β-D-glucopyranosyloxy)-1*H*-pyrazole.

^{1}H—NMR ($CDCl_3$) δ ppm:

1.05-1.15 (6H, m), 1.81 (3H, s), 1.98 (3H, s), 2.02 (3H, s), 2.05-2.15 (2H, m), 2.16 (3H, s), 2.26 (3H, s), 2.56 (2H, t, J=7.1Hz), 2.7-2.85 (1H, m), 3.5 (1H, d, J=16.5Hz), 3.6 (1H, d, J=16.5Hz), 3.9-4.0 (2H, m), 4.0-4.1 (1H, m), 4.1-4.2 (2H, m), 5.07 (1H,

dd, J=10.6Hz, 3.6Hz), 5.13 (2H, s), 5.35-5.45 (2H, m), 5.52 (1H, d, J=8.2Hz), 6.55 (1H, dd, J=8.6Hz, 2.5Hz), 6.66 (1H, d, J=2.5Hz), 6.79 (1H, d, J=8.6Hz), 7.25-7.4 (5H, m)

Reference Example 64

4-({4-[3-(Benzyloxycarbonyl)propoxy]-2-(tetrahydro-4*H*-pyran-4-yloxy)phenyl}methyl)-5-isopropyl-3-(2,3,4,6-tetra-*O*-pivaloyl-β-D-glucopyranosyloxy)-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Reference Example 27 using 4-{[4-hydroxy-2-(tetrahydro-4*H*-pyran-4-yloxy)phenyl]methyl}-5-isopropyl-3-(2,3,4,6-tetra-*O*-pivaloyl-β-D-glucopyranosyloxy)-1*H*-pyrazole instead of 4-[(4-hydroxy-2-methylphenyl)methyl]-5-isopropyl-3-(2,3,4,6-tetra-*O*-pivaloyl-β-D-glucopyranosyl-oxy)-1*H*-pyrazole.

^{1}H−NMR ($CDCl_3$) δ ppm:

1.0-1.2 (42H, m), 1.75-1.85 (2H, m), 1.95-2.15 (4H, m), 2.56 (2H, t, J=7.3Hz), 2.8-2.95 (1H, m), 3.5-3.65 (4H, m), 3.8-3.9 (1H, m), 3.9-4.05 (4H, m), 4.05-4.25 (2H, m), 4.4-4.5 (1H, m), 5.13 (2H, s), 5.15-5.3 (2H, m), 5.36 (1H, t, J=9.5Hz), 5.66 (1H, d, J=8.1Hz), 6.3 (1H, dd, J=8.4Hz, 2.5Hz), 6.38 (1H, d, J=2.5Hz), 6.84 (1H, d, J=8.4Hz), 7.25-7.4 (5H, m)

Reference Example 65

3-(2,3,4,6-Tetra-*O*-acetyl-β-D-galactopyranosyloxy)-4-{[4-(3-carboxypropoxy)-2-methylphenyl]methyl}-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Reference Example 25 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-galactopyranosyloxy)-4-({4-[3-(benzyloxy-carbonyl)propoxy]-2-methylphenyl}methyl)-5-isopropyl-1*H*-pyrazole instead of 4-[(4-benzyloxy-2-methylphenyl)methyl]-5-isopropyl-3-(2,3,4,6-tetra-*O*-pivaloyl-β-D-glucopyranosyl-oxy)-1*H*-pyrazole.

^{1}H—NMR ($CDCl_3$) δ ppm:

1.05-1.15 (6H, m), 1.78 (3H, s), 1.98 (3H, s), 2.02 (3H, s), 2.05-2.15 (2H, m), 2.16 (3H, s), 2,27 (3H, s), 2.45-2.6 (2H, m), 2.75-2.85 (1H, m), 3.49 (1H, d, J=16.8Hz), 3.6 (1H, d, J=16.8Hz), 3.98 (2H, t, J=6.3Hz), 4.0-4.1 (1H, m), 4.1-4.25 (2H, m), 5.06 (1H, dd, J=10.3Hz, 3.4Hz), 5.3-5.45 (3H, m), 6.58 (1H, dd, J=8.6Hz, 2.4Hz), 6.68 (1H, d, J=2.4Hz), 6.78 (1H, d, J=8.6Hz)

Reference Example 66

4-{[4-(3-Carboxypropoxy)-2-(tetrahydro-4H-pyran-4-yloxy)-phenyl]methyl}-5-isopropyl-3-(2,3,4,6-tetra-O-pivaloyl-β-D-glucopyranosyloxy)-1H-pyrazole

The title compound was prepared in a similar manner to that described in Reference Example 25 using 4-({4-[3-(benzyl-oxycarbonyl)propoxy]-2-(tetrahydro-4*H*-pyran-4-yloxy)-phenyl}methyl)-5-isopropyl-3-(2,3,4,6-tetra-*O*-pivaloyl-β-D-glucopyranosyloxy)-1*H*-pyrazole instead of 4-[(4-benzyloxy-2-methylphenyl)methyl]-5-isopropyl-3-(2,3,4,6-tetra-*O*-pivaloyl-β-D-glucopyranosyloxy)-1*H*-pyrazole.

^{1}H—NMR ($CDCl_3$) δ ppm:

1.0-1.2 (42H, m), 1.75-1.9 (2H, m), 1.95-2.15 (4H, m), 2.5-2.6 (2H, m), 2.8-2.95 (1H, m), 3.45-3.65 (4H, m), 3.8-3.9 (1H, m), 3.9-4.05 (4H, m), 4.1-4.25 (2H, m), 4.4-4.55 (1H, m), 5.2-5.3 (2H, m), 5.36 (1H, t, J=9.2Hz), 5.52 (1H, d, J=7.7Hz), 6.33 (1H, dd, J=8.1Hz, 2.1Hz), 6.41 (1H, d, J=2.1Hz), 6.84 (1H, d, J=8.1Hz)

Reference Example 67

3-(2,3,4,6-Tetra-*O*-acetyl-β-D-galactopyranosyloxy)-4-[(4-{3-[1-benzyloxycarbonyl-1-(methyl)ethylcarbamoyl]propoxy}-2-methylphenyl)methyl]-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Reference Example 45 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-galactopyranosyloxy)-4-{[4-(3-carboxypropoxy)-2-methylphenyl]methyl}-5-isopropyl-1*H*-pyrazole instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-{[4-(2-carboxyethoxy)-2-methylphenyl]methyl}-5-isopropyl-1*H*-pyrazole.

^{1}H−NMR ($CDCl_3$) δ ppm:

1.05-1.15 (6H, m), 1.53 (6H, s), 1.83 (3H, s), 1.95-2.1 (8H, m), 2.15 (3H, s), 2.26 (3H, s), 2.34 (2H, t, J=7.2Hz), 2.7-2.85 (1H, m), 3.5 (1H, d, J=16.6Hz), 3.6 (1H, d, J=16.6Hz), 3.85-3.95 (2H, m), 4.0-4.1 (1H, m), 4.1-4.2 (2H, m), 5.07 (1H, dd, J=10.4Hz, 3.5Hz), 5.15 (2H, s), 5.35-5.45 (2H, m), 5.52 (1H, d, J=8.1Hz), 6.06 (1H, s), 6.55 (1H, dd, J=8.5Hz, 2.6Hz), 6.66 (1H, d, J=2.6Hz), 6.79 (1H, d, J=8.5Hz), 7.25-7.4 (5H, m)

Reference Example 68

4-{[4-{3-[1-Benzyloxycarbonyl-1-(methyl)ethylcarbamoyl]-propoxy}-2-(tetrahydro-4*H*-pyran-4-yloxy)phenyl]methyl}-5-isopropyl-3-(2,3,4,6-tetra-*O*-pivaloyl-β-D-glucopyranosyl-oxy)-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Reference Example 45 using 4-{[4-(3-carboxy-propoxy)-2-(tetrahydro-4*H*-pyran-4-yloxy)phenyl]methyl}-5-isopropyl-3-(2,3,4,6-tetra-*O*-pivaloyl-β-D-glucopyranosyl-oxy)-1*H*-pyrazole instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-{[4-(2-carboxyethoxy)-2-methyl-phenyl]methyl}-5-isopropyl-1*H*-pyrazole.

^{1}H−NMR ($CDCl_3$) δ ppm:

1.0-1.2 (42H, m), 1.54 (6H, s), 1.75-1.85 (2H, m), 2.0-2.1 (4H, m), 2.34 (2H, t, J=7.2Hz), 2.8-2.95 (1H, m), 3.5-3.65 (4H, m), 3.8-4.05 (5H, m), 4.05-4.25 (2H, m), 4.4-4.5 (1H, m), 5.1-5.3 (4H, m), 5.36 (1H, t, J=9.5Hz), 5.65 (1H, d, J=7.5Hz), 6.09 (1H, brs), 6.29 (1H, dd, J=8.3Hz, 2.2Hz), 6.4 (1H, d, J=2.2Hz), 6.83 (1H, d, J=8.3Hz), 7.25-7.4 (5H, m)

Reference Example 69

3-(2,3,4,6-Tetra-*O*-acetyl-β-D-galactopyranosyloxy)-4-[(4-{3-[1-carboxy-1-(methyl)ethylcarbamoyl]propoxy}-2-methyl-phenyl)methyl]-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Reference Example 48 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-galactopyranosyloxy)-4-[(4-{3-[1-benzyloxy-carbonyl-1-(methyl)ethylcarbamoyl]propoxy}-2-methylphenyl)-

methyl]-5-isopropyl-1*H*-pyrazole instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-{2-[1-benzyloxy-carbonyl-1-(methyl)ethylcarbamoyl]ethoxy}-2-methylphenyl)-methyl]-5-isopropyl-1*H*-pyrazole.

^{1}H−NMR ($CDCl_3$) δ ppm:

1.05-1.15 (6H, m), 1.55 (3H, s), 1.56 (3H, s), 1.79 (3H, s), 1.98 (3H, s), 2.0-2.2 (8H, m), 2.26 (3H, s), 2.4 (2H, t, J=6.9Hz), 2.7-2.85 (1H, m), 3.49 (1H, d, J=16.6Hz), 3.59 (1H, d, J=16.6Hz), 3.98 (2H, t, J=6.1Hz), 4.0-4.2 (2H, m), 4.22 (1H, dd, J=10.9Hz, 5.7Hz), 5.0-5.1 (1H, m), 5.3-5.45 (3H, m), 6.24 (1H, s), 6.59 (1H, dd, J=8.2Hz, 2.7Hz), 6.69 (1H, d, J=2.7Hz), 6.75 (1H, d, J=8.2Hz)

Reference Example 70

4-{[4-{3-[1-Carboxy-1-(methyl)ethylcarbamoyl]propoxy}-2-(tetrahydro-4*H*-pyran-4-yloxy)phenyl]methyl}-5-isopropyl-3-(2,3,4,6-tetra-*O*-pivaloyl-β-D-glucopyranosyloxy)-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Reference Example 48 using 4-{[4-{3-[1-benzyl-oxycarbonyl-1-(methyl)ethylcarbamoyl]propoxy}-2-(tetra-hydro-4*H*-pyran-4-yloxy)phenyl]methyl}-5-isopropyl-3-(2,3,4,6-tetra-*O*-pivaloyl-β-D-glucopyranosyloxy)-1*H*-pyrazole instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-gluco-pyranosyloxy)-4-[(4-{2-[1-benzyloxycarbonyl-1-(methyl)-ethylcarbamoyl]ethoxy}-2-methylphenyl)methyl]-5-isopropyl-1*H*-pyrazole.

^{1}H−NMR ($CDCl_3$) δ ppm:

1.0-1.2 (42H, m), 1.54 (6H, s), 1.7-1.9 (2H, m), 1.95-2.15 (4H, m), 2.35-2.45 (2H, m), 2.8-2.95 (1H, m), 3.45-3.65 (4H, m), 3.8-3.9 (1H, m), 3.9-4.05 (4H, m), 4.05-4.25 (2H, m), 4.4-4.55 (1H, m), 5.15-5.3 (2H, m), 5.36 (1H, t, J=9.4Hz), 5.56 (1H, d, J=8.4Hz), 6.17 (1H, brs), 6.32 (1H, d, J=8.1Hz), 6.41 (1H, s), 6.82 (1H, d, J=8.1Hz)

Example 112

3-(β-D-Galactopyranosyloxy)-5-isopropyl-4-{[4-(3-{1-[(piperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}-propoxy)-2-methylphenyl]methyl}-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 99 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-galactopyranosyloxy)-4-[(4-{3-[1-carboxy-1-(methyl)-ethylcarbamoyl]propoxy}-2-methylphenyl)methyl]-5-isopropyl-1*H*-pyrazole and 1-(benzyloxycarbonyl)piperazine instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-{2-[1-carboxy-1-(methyl)ethylcarbamoyl]ethoxy}-2-methyl-phenyl)methyl]-5-isopropyl-1*H*-pyrazole and 1-benzyl-piperazine, respectively.

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.2 (6H, m), 1.42 (6H, s), 1.95-2.05 (2H, m), 2.29 (3H, s), 2.39 (2H, t, J=7.4Hz), 2.55-2.9 (5H, m), 3.45-3.8 (11H, m), 3.85 (1H, d, J=3.2Hz), 3.95 (2H, t, J=6.1Hz), 5.04 (1H, d, J=7.5Hz), 6.61 (1H, dd, J=8.2Hz, 2.4Hz), 6.71 (1H, d, J=2.4Hz), 6.84 (1H, d, J=8.2Hz)

Example 113

3-(β-D-Galactopyranosyloxy)-5-isopropyl-4-[(4-{3-[1-{[4-(2-hydroxyethyl)piperazin-1-yl]carbonyl}-1-(methyl)ethyl-carbamoyl]propoxy}-2-methylphenyl)methyl]-1H-pyrazole

The title compound was prepared in a similar manner to that described in Example 78 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-galactopyranosyloxy)-4-[(4-{3-[1-carboxy-1-(methyl)ethylcarbamoyl]propoxy}-2-methylphenyl)methyl]-5-isopropyl-1*H*-pyrazole and 1-(2-hydroxyethyl)piperazine instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-{[4-(2-carboxyethoxy)-2-methylphenyl]methyl}-5-isopropyl-1*H*-pyrazole and 2-amino-2-methylpropionamide, respectively.

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.15 (6H, m), 1.42 (6H, s), 1.95-2.05 (2H, m), 2.28 (3H, s), 2.3-2.55 (8H, m), 2.7-2.85 (1H, m), 3.45-3.8 (13H, m), 3.85 (1H, d, J=2.9Hz), 3.94 (2H, t, J=6.0Hz), 5.04 (1H, d, J=7.6Hz), 6.6 (1H, d, J=8.5Hz), 6.7 (1H, s), 6.85 (1H, d, J=8.5Hz)

Example 114

3-(β-D-Glucopyranosyloxy)-5-isopropyl-4-{[4-(3-{1-[(piperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}-propoxy)-2-(tetrahydro-4*H*-pyran-4-yloxy)phenyl]methyl}-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 105 using 4-{[4-{3-[1-carboxy-1-(methyl)ethylcarbamoyl]propoxy}-2-(tetrahydro-4*H*-pyran-4-

yloxy)phenyl]methyl}-5-isopropyl-3-(2,3,4,6-tetra-*O*-pivaloyl-β-D-glucopyranosyloxy)-1*H*-pyrazole instead of 4-[(4-{3-[1-carboxy-1-(methyl)ethylcarbamoyl]propoxy}-2-methylphenyl)methyl]-5-isopropyl-3-(2,3,4,6-tetra-*O*-pivaloyl-β-D-glucopyranosyloxy)-1*H*-pyrazole.

^{1}H−NMR (CD_3OD) δ ppm:

1.05-1.2 (6H, m), 1.42 (6H, s), 1.7-1.85 (2H, m), 1.95-2.1 (4H, m), 2.38 (2H, t, J=7.4Hz), 2.6-2.8 (4H, m), 2.8-2.95 (1H, m), 3.25-3.45 (4H, m), 3.5-3.75 (9H, m), 3.83 (1H, d, J=12.1Hz), 3.9-4.0 (4H, m), 4.5-4.65 (1H, m), 5.07 (1H, d, J=7.1Hz), 6.4 (1H, dd, J=8.3Hz, 2.5Hz), 6.54 (1H, d, J=2.5Hz), 6.89 (1H, d, J=8.3Hz)

Reference Example 71

4-[(4-Bromo-2-fluorophenyl)methyl]-1,2-dihydro-5-isopropyl-3*H*-pyrazol-3-one

The title compound was prepared in a similar manner to that described in Reference Example 2 using 4-bromo-2-fluorobenzyl bromide instead of 4-bromobenzyl bromide.

^{1}H−NMR ($CDCl_3$) δ ppm:

1.17 (6H, d, J=7.1Hz), 2.85-3.05 (1H, m), 3.67 (2H, s), 7.0-7.3 (3H, m)

Reference Example 72

3-(2,3,4,6-Tetra-*O*-acetyl-β-D-galactopyranosyloxy)-4-[(4-bromo-2-fluorophenyl)methyl]-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to

that described in Reference Example 12 using 4-[(4-bromo-2-fluorophenyl)methyl]-1,2-dihydro-5-isopropyl-3*H*-pyrazol-3-one and acetobromo-α-D-galactose instead of 4-{[4-(2-benzyloxycarbonyl-2-methylpropoxy)phenyl]methyl}-1,2-dihydro-5-isopropyl-3*H*-pyrazol-3-one and acetobromo-α-D-glucose, respectively.

^{1}H—NMR ($CDCl_3$) δ ppm:

1.15-1.25 (6H, m), 1.92 (3H, s), 1.99 (3H, s), 2.02 (3H, s), 2.18 (3H, s), 2.9-3.0 (1H, m), 3.59 (1H, d, J=16.1Hz), 3.67 (1H, d, J=16.1Hz), 4.05-4.25 (3H, m), 5.1 (1H, dd, J=10.4Hz, 3.4Hz), 5.35-5.45 (2H, m), 5.58 (1H, d, J=8.1Hz), 6.95-7.05 (1H, m), 7.1-7.2 (2H, m)

Reference Example 73

<u>3-(2,3,4,6-Tetra-*O*-acetyl-β-D-galactopyranosyloxy)-4-({4-[(1*E*)-3-carboxyprop-1-enyl]-2-fluorophenyl}methyl)-5-isopropyl-1*H*-pyrazole</u>

The title compound was prepared in a similar manner to that described in Reference Example 4 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-galactopyranosyloxy)-4-[(4-bromo-2-fluorophenyl)methyl]-5-isopropyl-1*H*-pyrazole instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-bromophenyl)methyl]-5-isopropyl-1*H*-pyrazole.

^{1}H—NMR ($CDCl_3$) δ ppm:

1.1-1.2 (6H, m), 1.89 (3H, s), 1.99 (3H, s), 2.01 (3H, s), 2.17 (3H, s), 2.85-3.0 (1H, m), 3.27 (2H, d, J=6.9Hz), 3.59 (1H, d, J=16.2Hz), 3.7 (1H, d, J=16.2Hz), 4.05-4.3 (3H, m), 5.1 (1H,

dd, J=10.2Hz, 3.5Hz), 5.3-5.5 (3H, m), 6.2-6.35 (1H, m), 6.43 (1H, d, J=16.2Hz), 6.9-7.15 (3H, m)

Reference Example 74

1-(2-Amino-2-methylpropionyl)-4-(benzyloxycarbonyl)-piperazine

To a solution of 2-(*tert*-butoxycarbonylamino)-2-methyl-propionic acid (10 g) in tetrahydrofuran (20 mL) were added 1-(benzyloxycarbonyl)piperazine (16.3 g), 1-hydroxybenzo-triazole (8.02 g) and 1-ethyl-3-(3-dimethylaminopropyl)-carbodiimide hydrochloride (11.4 g), and the mixture was stirred at room temperature overnight. The reaction mixture was poured into water, and the resulting mixture was extracted with ethyl acetate. The extract was washed with water and brine, and dried over anhydrous sodium sulfate. The solvent was removed under reduced pressure. The residue was dissolved in a mixed solvent of *n*-hexane and ethyl acetate (1/1) (40 mL) at 60°C with heating, and the solution was stirred at room temperature overnight. To the mixture was added the same solvent (30 mL), and the mixture was further stirred overnight. The precipitated crystals were collected by filtration, and washed with the same solvent and dried under reduced pressure to give 4-benzyloxycarbonyl-1-[2-(*tert*-butoxycarbonylamino)-2-methylpropionyl]piperazine (13.5 g). To a solution of the obtained 4-benzyloxycarbonyl-1-[2-(*tert*-butoxycarbonylamino)-2-methylpropionyl]-piperazine (5 g) in tetrahydrofuran (30 mL) was added hydrochloric acid (4 mol/L 1,4-dioxane solution, 40 mL), and

the mixture was stirred at room temperature overnight. The precipitated crystals were collected by filtration. The obtained crystals were dissolved in ethyl acetate and a saturated aqueous sodium hydrogen carbonate solution. The organic layer was separated, and the organic layer was washed with brine and dried over anhydrous sodium sulfate. The solvent was removed under reduced pressure to give the title compound (3.65 g).

^{1}H−NMR ($CDCl_3$) δ ppm:

1.41 (6H, s), 3.45-3.55 (4H, m), 3.7-3.95 (4H, br), 5.15 (2H, s), 7.25-7.4 (5H, m)

Example 115

4-{[2-Fluoro-4-(3-{1-[(piperazin-1-yl)carbonyl]-1-(methyl)-ethylcarbamoyl}propyl)phenyl]methyl}-3-(β-D-galacto-pyranosyloxy)-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 99 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-galactopyranosyloxy)-4-({4-[(1*E*)-3-carboxyprop-1-enyl]-2-fluorophenyl}methyl)-5-isopropyl-1*H*-pyrazole and 1-(2-amino-2-methylpropionyl)-4-(benzyloxycarbonyl)piperazine instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-{2-[1-carboxy-1-(methyl)ethylcarbamoyl]ethoxy}-2-methyl-phenyl)methyl]-5-isopropyl-1*H*-pyrazole and 1-benzyl-piperazine, respectively.

^{1}H−NMR (CD_3OD) δ ppm:

1.1-1.2 (6H, m), 1.42 (6H, s), 1.8-1.95 (2H, m), 2.17 (2H, t, J=7.6Hz), 2.6 (2H, t, J=7.6Hz), 2.7-2.85 (4H, m), 2.85-3.0 (1H,

m), 3.45-3.85 (11H, m), 3.85-3.9 (1H, m), 5.09 (1H, d, J=7.8Hz), 6.8-6.9 (2H, m), 7.0-7.15 (1H, m)

Reference Example 75

4-Bromo-2-chlorobenzyl alcohol

The title compound was prepared in a similar manner to that described in Reference Example 14 using 4-bromo-2-chlorobenzoic acid instead of 4-bromo-2-methylbenzoic acid.

^{1}H−NMR ($CDCl_3$) δ ppm:

1.9-2.0 (1H, m), 4.73 (2H, d, J=5.5Hz), 7.3-7.45 (2H, m), 7.45-7.55 (1H, m)

Reference Example 76

4-[(4-Bromo-2-chlorophenyl)methyl]-1,2-dihydro-5-isopropyl-3*H*-pyrazol-3-one

The title compound was prepared in a similar manner to that described in Reference Example 15 using 4-bromo-2-chlorobenzyl alcohol instead of 4-bromo-2-methylbenzyl alcohol.

^{1}H−NMR (DMSO-d_6) δ ppm:

1.07 (6H, d, J=6.9Hz), 2.7-2.85 (1H, m), 3.61 (2H, s), 6.97 (1H, d, J=8.5Hz), 7.46 (1H, dd, J=8.5Hz, 2.0Hz), 7.66 (1H, d, J=2.0Hz)

Reference Example 77

3-(2,3,4,6-Tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-bromo-2-chlorophenyl)methyl]-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Reference Example 12 using 4-[(4-bromo-2-

chlorophenyl)methyl]-1,2-dihydro-5-isopropyl-3*H*-pyrazol-3-one instead of 4-{[4-(2-benzyloxycarbonyl-2-methylpropoxy)-phenyl]methyl}-1,2-dihydro-5-isopropyl-3*H*-pyrazol-3-one.

^{1}H−NMR ($CDCl_3$) δ ppm:

1.17 (6H, d, J=7.0Hz), 1.9 (3H,s), 2.01 (3H, s), 2.03 (3H, s), 2.07 (3H, s), 2.85-3.0 (1H, m), 3.65 (1H, d, J=16.7Hz), 3.74 (1H, d, J=16.7Hz), 3.8-3.9 (1H, m), 4.05-4.2 (1H, m), 4.31 (1H, dd, J=12.8Hz, 4.3Hz), 5.1-5.35 (3H, m), 5.6 (1H, d, J=8.1Hz), 6.93 (1H, d, J=8.2Hz), 7.24 (1H, dd, J=8.2Hz, 1.8Hz), 7.49 (1H, d, J=1.8Hz)

Reference Example 78

3-(2,3,4,6-Tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-({4-[(1*E*)-3-carboxyprop-1-enyl]-2-chlorophenyl}methyl)-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Reference Example 4 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-bromo-2-chlorophenyl)methyl]-5-isopropyl-1*H*-pyrazole instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-bromophenyl)-methyl]-5-isopropyl-1*H*-pyrazole.

^{1}H−NMR ($CDCl_3$) δ ppm:

1.1-1.2 (6H, m), 1.85 (3H, s), 2.0 (3H, s), 2.02 (3H, s), 2.05 (3H, s), 2.85-3.0 (1H, m), 3.27 (2H, d, J=6.4Hz), 3.68 (1H, d, J=16.7Hz), 3.78 (1H, d, J=16.7Hz), 3.8-3.9 (1H, m), 4.1-4.2 (1H, m), 4.32 (1H, dd, J=12.6Hz, 3.8Hz), 5.15-5.3 (3H, m), 5.43 (1H, d, J=7.8Hz), 6.2-6.35 (1H, m), 6.42 (1H, d, J=16.1Hz), 6.96 (1H,

d, J=1.6Hz), 7.13 (1H, dd, J=8.2Hz, 1.6Hz), 7.36 (1H, d, J=1.6Hz)

Example 116

4-{[2-Chloro-4-(3-{1-[(piperazin-1-yl)carbonyl]-1-(methyl)-ethylcarbamoyl}propyl)phenyl]methyl}-3-(β-D-glucopyranosyl-oxy)-5-isopropyl-1*H*-pyrazole

The title compound was prepared in a similar manner to that described in Example 99 using 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-({4-[(1*E*)-3-carboxyprop-1-enyl]-2-chlorophenyl}methyl)-5-isopropyl-1*H*-pyrazole and 1-(2-amino-2-methylpropionyl)-4-(benzyloxycarbonyl)piperazine instead of 3-(2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyloxy)-4-[(4-{2-[1-carboxy-1-(methyl)ethylcarbamoyl]ethoxy}-2-methyl-phenyl)methyl]-5-isopropyl-1*H*-pyrazole and 1-benzyl-piperazine, respectively.

^{1}H−NMR (CD_3OD) δ ppm:

1.1-1.2 (6H, m), 1.43 (6H, s), 1.8-1.95 (2H, m), 2.17 (2H, t, J=7.7Hz), 2.59 (2H, t, J=7.6Hz), 2.65-2.95 (5H, m), 3.25-3.45 (4H, m), 3.5-3.9 (8H, m), 5.09 (1H, d, J=7.1Hz), 6.95-7.1 (2H, m), 7.2 (1H, d, J=1.3Hz)

Test Example 1

Assay for inhibitory effects on human SGLT1 activity

1) Cloning and construction of the vector expressing human SGLT1

The cDNA library was prepared for PCR amplification by reverse transcription from total RNA deprived from human small intestine (Ori gene) using oligo-dT as a primer. Using this

cDNA library as a template, the DNA fragment coding 1 to 2005 bp of human SGLT1 (ACCESSION: M24847), which was reported by Hediger et al., was amplified by PCR method and inserted into the multi-cloning site of pcDNA3.1(-) (Invitrogen). The DNA sequence inserted was perfectly matched to the previously reported sequence.

2) Establishment of cell line stably expressing human SGLT1

The expression vector of human SGLT1 was digested by Sca I into a linear DNA. The linear DNA was transfected into CHO-K1 cells by means of lipofection (Effectene Transfection Reagent: QIAGEN). Neomycin resistant cell lines were selected by culture in the medium containing G418 (1 mg/mL, LIFE TECHNOLOGIES), and then the activity against the uptake of methyl-α-D-glucopyranoside was measured by the method described below. The cell line, which showed the greatest uptake activity, was selected and designated as CS1-5-11D. CS1-5-11D cells were cultured in the presence of G418 at 200 μg/mL.

3) Measurement of the inhibitory activity against the uptake of methyl-α-D-glucopyranoside (α-MG)

CS1-5-11D cells were seeded into a 96-well culture plate at a density of 3×10^4 cells/well and cultured for 2 days, and were used in the uptake assay. A mixture of non-labeled (Sigma) and ^{14}C-labeled α-MG (Amersham Pharmcia Biotec) was added to the uptake buffer (pH 7.4; containing 140 mM sodium chloride, 2 mM potassium chloride, 1 mM calcium chloride, 1 mM magnesium chloride, 10 mM 2-[4-(2-hydroxyethyl)-1-piperazinyl]ethane sulfonic acid, and 5 mM tris(hydroxymethyl)aminomethane) at the

final concentration of 1 mM. A test compound was dissolved in dimethyl sulfoxide, and then appropriately diluted with distilled water. The test compound solution was added to the uptake buffer containing 1 mM α-MG, and designated as a measurement buffer. For the control group, the measurement buffer without any test compound was prepared. For measuring the basal uptake, a basal uptake measurement buffer which contains 140 mM chorine chloride instead of sodium chloride was prepared. After removing the culture medium of CS1-5-11D cells, 180 μL of the pre-treatment buffer (the basal uptake buffer without α-MG) was added to each well and incubated at 37° C for 10 minutes. After repeating the same treatment, the pre-treatment buffer was removed. To each well was added 75 μL of the measurement buffer or the basal uptake buffer was added and incubated at 37° C for 1 hour. After removing the measurement buffer, cells were washed twice with 180 μL per well of the washing buffer (the basal uptake buffer containing 10 mM non-labeled α-MG). The cells were solubilized by 75 μL per well of 0.2 mol/L sodium hydroxide. The cell lysates were transferred into PicoPlates™ (Packard), and then added 150 μL of MicroScint™-40 (Packard) and mixed. Radioactivity was measured by means of micro-scintillation counter TopCount™ (Packard). One hundred % was set to the difference between the uptake in the control group and the basal uptake, and the uptake of methyl α-D-gluco-pyranoside at each drug concentration were calculated. The drug concentration, at which 50% uptake of methyl α-D-glucopyranoside was inhibited (IC_{50} value), was calculated using logit plot.

The results are shown in Table 1.

[Table 1]

Test compound	IC_{50} value (nM)
Example 15	113
Example 18	181
Example 21	12
Example 24	24
Example 27	237
Example 28	267
Example 29	431
Example 30	52
Example 31	96
Example 32	220
Example 33	174
Example 34	245
Example 35	115
Example 48	31
Example 57	39
Example 61	18

Test Example 2

Assay for inhibitory effects on blood glucose level increase in rats

1) Preparation of diabetic rat model

Male wistar rats (Japan Charles River), aged 8 weeks old,

were injected nicotinamide (230 mg/kg) intraperitoneally. Fifteen minutes after injection, they were injected streptozotocin (85 mg/kg) intravenously from tail vain under anesthesia with ether. After a week, rats were fasted overnight and then glucose tolerance test (2 g/kg) was done. The rats which showed plasma glucose concentration at 1 hour after glucose load was over 300 mg/dL were selected to use liquid meal tolerance test.

2) Liquid meal tolerance test

After overnight fasted, the diabetic rats were orally administered a test compound (1 mg/kg), which was dissolved in distilled water, in the drug-treating group, or distilled water alone in a control group. Immediately after the compound administration, 17.25 kcal/kg of liquid meal (No. 038, Control diet, assorted with dextrin and maltose; Oriental Yeast Co., Ltd.) was loaded orally. The blood was collected from tail artery immediately before and after administration with the time course, and treated with heparin immediately. The blood was centrifuged, and the plasma was collected to quantify the plasma glucose concentration by glucose oxidase method. Plasma glucose concentrations at pretreatment (0h), 0.5 and 1 hour after the drug administration are shown in Table 2. The values in the table are presented as the mean ± S.E.

[Table 2]

Test compound	Plasma glucose concentration (mg/dL)		
	0h	0.5h	1h
Control	117 ± 8	326 ± 46	297 ± 35
Example 21	118 ± 9	156 ± 15	178 ± 19
Control	121 ± 7	313 ± 33	303 ± 63
Example 30	121 ± 6	163 ± 8	187 ± 9
Control	140 ± 11	280 ± 22	287 ± 23
Example 32	125 ± 8	223 ± 20	278 ± 32
Example 33	127 ± 11	207 ± 8	251 ± 21
Control	116 ± 11	241 ± 15	237 ± 10
Example 48	112 ± 5	139 ± 4	132 ± 4
Control	133 ± 9	236 ± 9	210 ± 11
Example 57	126 ± 6	149 ± 7	158 ± 10
Control	122 ± 6	277 ± 16	272 ± 21
Example 61	116 ± 6	136 ± 6	172 ± 37

Test Example 3

Acute toxicity test

Male ICR mice (CLEA Japan, Inc.; 32-37 g, n = 5), aged 6 weeks old, were fasted for 4 hours. A test compound, which was dissolved in distilled water, was administered orally at a dose of 1 g/kg, and then mice were observed for 24 hours. The results are shown in the following Table 3.

[Table 3]

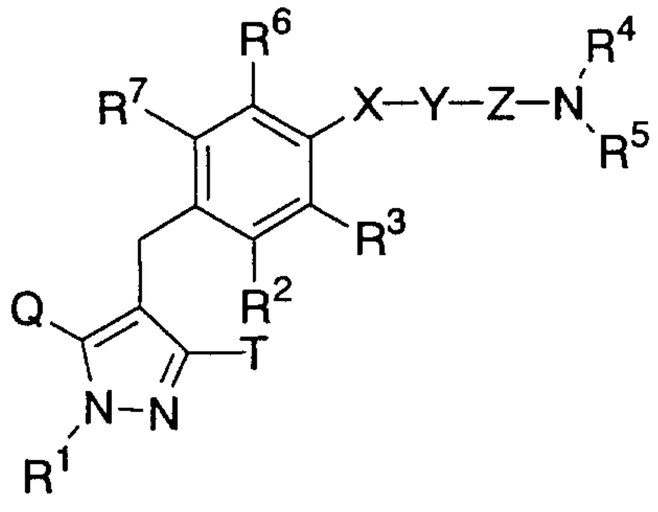
Test compound	Number of death
Example 57	0/5

Industrial Applicability

The pyrazole derivatives represented by the above general formula (I) of the present invention, pharmaceutically acceptable salts thereof and prodrugs thereof exert an inhibitory activity in human SGLT1 and can suppress increase of blood glucose level by inhibiting absorption of carbohydrate such as glucose at the small intestine, and particularly, can normalize postprandial hyperglycemia by delaying carbohydrate absorption based on the mechanism. Therefore, the present invention can provide excellent agents for the prevention or treatment of a disease associated with hyperglycemia such as diabetes, impaired glucose tolerance, diabetic complications, obesity or the like. In addition, since the pyrazole derivatives represented by the above general formula (II) of the present invention and salts thereof are important as intermediates in the production of the pyrazole derivatives represented by the above general formula (I), the compounds represented by the above general formula (I) of the present invention can be readily prepared via such compounds.

CLAIMS

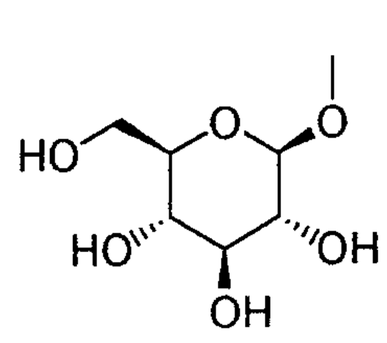
1. A pyrazole derivative represented by the general formula:



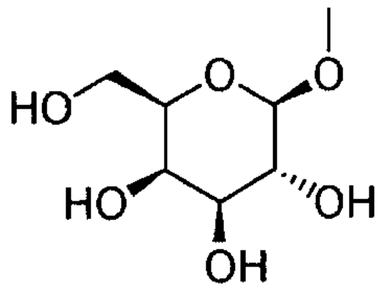
wherein

R^1 represents a hydrogen atom, a C_{1-6} alkyl group, a C_{2-6} alkenyl group, a hydroxy(C_{2-6} alkyl) group, a C_{3-7} cycloalkyl group, a C_{3-7} cycloalkyl-substituted (C_{1-6} alkyl) group, an aryl group which may have the same or different 1 to 3 substituents selected from the group consisting of a halogen atom, a hydroxy group, an amino group, a C_{1-6} alkyl group and a C_{1-6} alkoxy group, or an aryl(C_{1-6} alkyl) group which may have the same or different 1 to 3 substituents selected from the group consisting of a halogen atom, a hydroxy group, an amino group, a C_{1-6} alkyl group and a C_{1-6} alkoxy group on the ring;

one of Q and T represents a group represented by the formula:



or a group represented by the formula:



while the other represents a C_{1-6} alkyl group, a halo(C_{1-6} alkyl) group, a C_{1-6} alkoxy-substituted (C_{1-6} alkyl) group or a C_{3-7} cycloalkyl group;

R^2 represents a hydrogen atom, a halogen atom, a hydroxy group, a C_{1-6} alkyl group, a C_{1-6} alkoxy group, a C_{1-6} alkylthio group, a halo(C_{1-6} alkyl) group, a halo(C_{1-6} alkoxy) group, a C_{1-6} alkoxy-substituted (C_{1-6} alkoxy) group, a C_{3-7} cycloalkyl-substituted (C_{2-6} alkoxy) group or a group of the general formula: $-A-R^8$ in which A represents a single bond, an oxygen atom, a methylene group, an ethylene group, $-OCH_2-$ or $-CH_2O-$; and R^8 represents a C_{3-7} cycloalkyl group, a C_{2-6} heterocycloalkyl group, an aryl group which may have the same or different 1 to 3 substituents selected from the group consisting of a halogen atom, a hydroxy group, an amino group, a C_{1-6} alkyl group, a C_{1-6} alkoxy group, a C_{2-6} alkenyloxy group, a halo(C_{1-6} alkyl) group, a hydroxy(C_{1-6} alkyl) group, a carboxy group, a C_{2-7} alkoxycarbonyl group, a cyano group and a nitro group, or a heteroaryl group which may have a substituent selected from the group consisting of a halogen atom and a C_{1-6} alkyl group;

X represents a single bond, an oxygen atom or a sulfur atom;

Y represents a single bond, a C_{1-6} alkylene group or a C_{2-6} alkenylene group with the proviso that X is a single bond when Y is a single bond;

Z represents a carbonyl group or a sulfonyl group;

R^4 and R^5 are the same or different, and each represents a hydrogen atom or a C_{1-6} alkyl group which may have the same or different 1 to 3 groups selected from the following substituent group (i), or they bind together with the neighboring nitrogen atom to form a C_{2-6} cyclic amino group which may have a substituent selected from the group consisting of a C_{1-6} alkyl group and a hydroxy(C_{1-6} alkyl) group;

R^3, R^6 and R^7 are the same or different, and each represents a hydrogen atom, a halogen atom, a C_{1-6} alkyl group or a C_{1-6} alkoxy group; and

substituent group (i) consists of a hydroxy group, an amino group, a mono or di(C_{1-6} alkyl)amino group, a mono or di[hydroxy(C_{1-6} alkyl)]amino group, an ureido group, a sulfamide group, a mono or di(C_{1-6} alkyl)ureido group, a mono or di(C_{1-6} alkyl)sulfamide group, a C_{2-7} acylamino group, a C_{1-6} alkylsulfonylamino group, a group of the general formula: $-CON(R^9)R^{10}$ in which R^9 and R^{10} are the same or different, and each represents a hydrogen atom or a C_{1-6} alkyl group which may have the same or different 1 to 3 substituents selected from the group consisting of a hydroxy group, an amino group, a mono or di(C_{1-6} alkyl)amino group, a mono or di[hydroxy(C_{1-6} alkyl)]amino group, an ureido group, a mono or di(C_{1-6} alkyl)ureido group, a C_{2-7} acylamino group, a C_{1-6} alkylsulfonylamino group and a carbamoyl group, or they bind together with the neighboring nitrogen atom to form a C_{2-6} cyclic amino group which may have a substituent selected from the group

consisting of a C_{1-6} alkyl group and a hydroxy(C_{1-6} alkyl) group, a C_{3-7} cycloalkyl group, a C_{2-6} heterocycloalkyl group, an aryl group which may have the same or different 1 to 3 substituents selected from the group consisting of a halogen atom, a hydroxy group, an amino group, a C_{1-6} alkyl group and a C_{1-6} alkoxy group, a heteroaryl group which may have a substituent selected from the group consisting of a halogen atom and a C_{1-6} alkyl group, a C_{2-6} cyclic amino group which may have a substituent selected from the group consisting of a C_{1-6} alkyl group and a hydroxy(C_{1-6} alkyl) group, and a C_{1-4} aromatic cyclic amino group which may have a C_{1-6} alkyl group as a substituent,
or a pharmaceutically acceptable salt thereof.

2. A pyrazole derivative as claimed in claim 1, wherein Y represents a C_{1-6} alkylene group or a C_{2-6} alkenylene group; one of R^4 and R^5 represents a C_{1-6} alkyl group which has the same or different 1 to 3 groups selected from the following substituent group (i), the other represents a hydrogen atom or a C_{1-6} alkyl group which may have the same or different 1 to 3 groups selected from the following substituent group (i); and substituent group (i) consists of a hydroxy group, an amino group, a mono or di(C_{1-6} alkyl)amino group, a mono or di[hydroxy(C_{1-6} alkyl)]amino group, an ureido group, a sulfamide group, a mono or di(C_{1-6} alkyl)ureido group, a mono or di(C_{1-6} alkyl)sulfamide group, a C_{2-7} acylamino group, a C_{1-6} alkylsulfonylamino group, a group of the general formula: $-CON(R^9)R^{10}$ in which R^9 and R^{10} are the same or different, and each represents a hydrogen atom

or a C_{1-6} alkyl group which may have the same or different 1 to 3 substituents selected from the group consisting of a hydroxy group, an amino group, a mono or di(C_{1-6} alkyl)amino group, a mono or di[hydroxy(C_{1-6} alkyl)]amino group, an ureido group, a mono or di(C_{1-6} alkyl)ureido group, a C_{2-7} acylamino group, a C_{1-6} alkylsulfonylamino group and a carbamoyl group, or they bind together with the neighboring nitrogen atom to form a C_{2-6} cyclic amino group which may have a substituent selected from the group consisting of a C_{1-6} alkyl group and a hydroxy(C_{1-6} alkyl) group, a C_{3-7} cycloalkyl group, a C_{2-6} heterocycloalkyl group, an aryl group which may have the same or different 1 to 3 substituents selected from the group consisting of a halogen atom, a hydroxy group, an amino group, a C_{1-6} alkyl group and a C_{1-6} alkoxy group, a heteroaryl group which may have a substituent selected from the group consisting of a halogen atom and a C_{1-6} alkyl group, a C_{2-6} cyclic amino group which may have a substituent selected from the group consisting of a C_{1-6} alkyl group and a hydroxy(C_{1-6} alkyl) group, and a C_{1-4} aromatic cyclic amino group which may have a C_{1-6} alkyl group as a substituent, or a pharmaceutically acceptable salt thereof.

3. A pyrazole derivative as claimed in claim 2, wherein one of R^4 and R^5 represents a C_{1-6} alkyl group which has a group selected from the following substituent group (iA), the other represents a hydrogen atom; and substituent group (iA) is a group of the general formula: $-CON(R^{9A})R^{10A}$ in which R^{9A} and R^{10A} bind together with the neighboring nitrogen atom to form a C_{2-6} cyclic

amino group which may have a substituent selected from the group consisting of a C_{1-6} alkyl group and a hydroxy(C_{1-6} alkyl) group, or a pharmaceutically acceptable salt thereof.

4. A pyrazole derivative as claimed in any one of claims 1-3, wherein X represents a single bond; and Y represents a trimethylene group or a 1-propenylene group, or a pharmaceutically acceptable salt thereof.

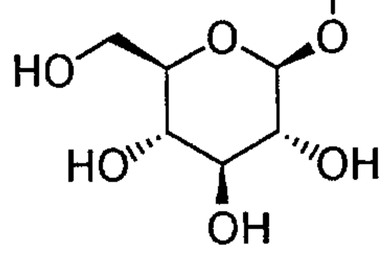
5. A pyrazole derivative as claimed in any one of claims 1-3, wherein X represents an oxygen atom; and Y represents an ethylene group or a trimethylene group, or a pharmaceutically acceptable salt thereof.

6. A pyrazole derivative as claimed in claim 1, wherein X represents a single bond; Y represents a single bond; one of R^4 and R^5 represents a C_{1-6} alkyl group which has the same or different 1 to 3 groups selected from the following substituent group (iB), the other represents a hydrogen atom or a C_{1-6} alkyl group which may have the same or different 1 to 3 groups selected from the following substituent group (iB); and substituent group (iB) consists of an ureido group, a sulfamide group, a mono or di(C_{1-6} alkyl)ureido group, a mono or di(C_{1-6} alkyl)sulfamide group, a C_{1-6} alkylsulfonylamino group, a group of the general formula: $-CON(R^{9B})R^{10B}$ in which one of R^{9B} and R^{10B} represents a C_{1-6} alkyl group which has the same or different 1 to 3 substituents selected from the group consisting of a hydroxy

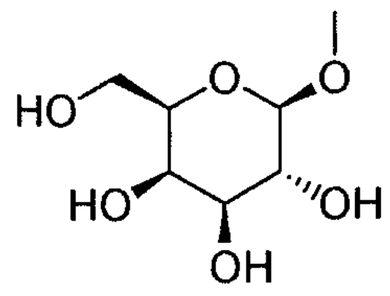
group, an amino group, a mono or di(C_{1-6} alkyl)amino group, a mono or di[hydroxy(C_{1-6} alkyl)]amino group, an ureido group, a mono or di(C_{1-6} alkyl)ureido group, a C_{2-7} acylamino group, a C_{1-6} alkylsulfonylamino group and a carbamoyl group, the other represents a hydrogen atom, a C_{1-6} alkyl group which may have the same or different 1 to 3 substituents selected from the group consisting of a hydroxy group, an amino group, a mono or di(C_{1-6} alkyl)amino group, a mono or di[hydroxy(C_{1-6} alkyl)]amino group, an ureido group, a mono or di(C_{1-6} alkyl)ureido group, a C_{2-7} acylamino group, a C_{1-6} alkylsulfonylamino group and a carbamoyl group, or they bind together with the neighboring nitrogen atom to form a C_{2-6} cyclic amino group which may have a substituent selected from the group consisting of a C_{1-6} alkyl group and a hydroxy(C_{1-6} alkyl) group, a C_{3-7} cycloalkyl group, a C_{2-6} heterocycloalkyl group, an aryl group which may have the same or different 1 to 3 substituents selected from the group consisting of a halogen atom, a hydroxy group, an amino group, a C_{1-6} alkyl group and a C_{1-6} alkoxy group, a heteroaryl group which may have a substituent selected from the group consisting of a halogen atom and a C_{1-6} alkyl group, a C_{2-6} cyclic amino group which may have a substituent selected from the group consisting of a C_{1-6} alkyl group and a hydroxy(C_{1-6} alkyl) group, and a C_{1-4} aromatic cyclic amino group which may have a C_{1-6} alkyl group as a substituent, or a pharmaceutically acceptable salt thereof.

7. A pyrazole derivative as claimed in any one of claims 1-6,

wherein R^1 represents a hydrogen atom or a hydroxy(C_{2-6} alkyl) group; T represents a group represented by the formula:

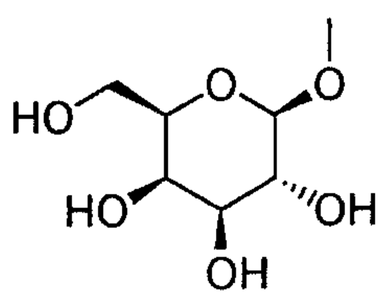


or a group represented by the formula:



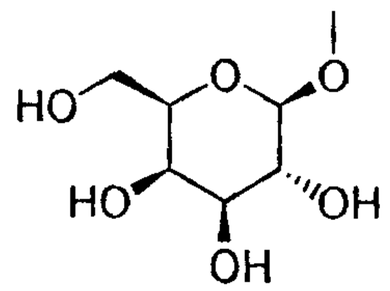
Q represents a C_{1-6} alkyl group or a halo(C_{1-6} alkyl) group; and R^3, R^6 and R^7 represent a hydrogen atom, or a pharmaceutically acceptable salt thereof.

8. A pyrazole derivative as claimed in any one of claims 1-6, wherein one of Q and T represents a group represented by the formula:



the other represents a C_{1-6} alkyl group, a halo(C_{1-6} alkyl) group, a C_{1-6} alkoxy-substituted (C_{1-6} alkyl) group or a C_{3-7} cycloalkyl group, or a pharmaceutically acceptable salt thereof.

9. A pyrazole derivative as claimed in claim 7 or 8, wherein T represents a group represented by the formula:



or a pharmaceutically acceptable salt thereof.

10. A pyrazole derivative as claimed in claim 7 or 9, wherein Q represents an isopropyl group, or a pharmaceutically acceptable salt thereof.

11. A pyrazole derivative as claimed in claim 1, which is a compound selected from the following group:

4-[(4-{3-[1-carbamoyl-1-(methyl)ethylcarbamoyl]propyl}-2-methylphenyl)methyl]-3-(β-D-glucopyranosyloxy)-5-isopropyl-1*H*-pyrazole;

3-(β-D-galactopyranosyloxy)-4-[(4-{3-[1-{[4-(2-hydroxyethyl)piperazin-1-yl]carbonyl}-1-(methyl)ethylcarbamoyl]propyl}phenyl)methyl]-5-isopropyl-1*H*-pyrazole;

3-(β-D-galactopyranosyloxy)-5-isopropyl-4-{[4-(3-{1-[2-(dimethylamino)ethylcarbamoyl]-1-(methyl)ethylcarbamoyl}propyl)phenyl]methyl}-1*H*-pyrazole;

4-[(4-{3-[1-(2-aminoethylcarbamoyl)-1-(methyl)ethylcarbamoyl]propyl}phenyl)methyl]-3-(β-D-galactopyranosyloxy)-5-isopropyl-1*H*-pyrazole;

3-(β-D-galactopyranosyloxy)-5-isopropyl-4-{[4-(3-{1-[(piperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}propyl)phenyl]methyl}-1*H*-pyrazole;

3-(β-D-glucopyranosyloxy)-4-[(4-{3-[1-{[4-(2-hydroxyethyl)piperazin-1-yl]carbonyl}-1-(methyl)ethylcarbamoyl]propyl}-2-methylphenyl)methyl]-5-isopropyl-1*H*-pyrazole;

3-(β-D-galactopyranosyloxy)-5-isopropyl-4-{[4-(3-{1-[(4-methylpiperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}-

propyl)phenyl]methyl}-1*H*-pyrazole;

3-(β-D-galactopyranosyloxy)-5-isopropyl-4-{[4-(3-{1-[(4-isopropylpiperazin-1-yl)carbonyl]-1-(methyl)ethyl-carbamoyl}propyl)phenyl]methyl}-1*H*-pyrazole;

3-(β-D-glucopyranosyloxy)-4-[(4-{3-[(*S*)-2-hydroxy-1-(methyl)ethylcarbamoyl]propyl}phenyl)methyl]-5-isopropyl-1*H*-pyrazole;

3-(β-D-glucopyranosyloxy)-4-[(4-{(1*E*)-3-[(*S*)-2-hydroxy-1-(methyl)ethylcarbamoyl]prop-1-enyl}phenyl)methyl]-5-isopropyl-1*H*-pyrazole;

3-(β-D-glucopyranosyloxy)-5-isopropyl-4-{[4-(2-{1-[(4-methylpiperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}-ethoxy)-2-methylphenyl]methyl}-1*H*-pyrazole;

3-(β-D-glucopyranosyloxy)-4-[(4-{2-[2-hydroxy-1,1-di-(methyl)ethylcarbamoyl]ethoxy}-2-methylphenyl)methyl]-5-isopropyl-1*H*-pyrazole;

3-(β-D-glucopyranosyloxy)-4-[(4-{2-[1-{[4-(2-hydroxyethyl)-piperazin-1-yl]carbonyl}-1-(methyl)ethylcarbamoyl]ethoxy}-2-methylphenyl)methyl]-5-isopropyl-1*H*-pyrazole;

3-(β-D-glucopyranosyloxy)-5-isopropyl-4-{[4-(2-{1-[(piperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}-ethoxy)-2-methylphenyl]methyl}-1*H*-pyrazole;

3-(β-D-glucopyranosyloxy)-5-isopropyl-4-{[4-(3-{1-[(piperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}-propyl)-2-methylphenyl]methyl}-1*H*-pyrazole;

3-(β-D-glucopyranosyloxy)-5-isopropyl-4-{[4-(3-{1-[(piperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}-

propoxy)-2-methylphenyl]methyl}-1*H*-pyrazole;

3-(β-D-glucopyranosyloxy)-4-[(4-{3-[1-{[4-(2-hydroxyethyl)-piperazin-1-yl]carbonyl}-1-(methyl)ethylcarbamoyl]propoxy}-2-methylphenyl)methyl]-5-isopropyl-1*H*-pyrazole;

3-(β-D-glucopyranosyloxy)-5-isopropyl-4-{[4-(3-{1-[(4-methylpiperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}propoxy)-2-methylphenyl]methyl}-1*H*-pyrazole;

3-(β-D-galactopyranosyloxy)-1-(3-hydroxypropyl)-5-isopropyl-4-{[4-(3-{1-[(piperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}propyl)phenyl]methyl}-1*H*-pyrazole;

3-(β-D-galactopyranosyloxy)-5-isopropyl-4-{[4-(3-{1-[(piperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}-propoxy)-2-methylphenyl]methyl}-1*H*-pyrazole;

4-{[2-fluoro-4-(3-{1-[(piperazin-1-yl)carbonyl]-1-(methyl)-ethylcarbamoyl}propyl)phenyl]methyl}-3-(β-D-galacto-pyranosyloxy)-5-isopropyl-1*H*-pyrazole;

4-{[2-chloro-4-(3-{1-[(piperazin-1-yl)carbonyl]-1-(methyl)-ethylcarbamoyl}propyl)phenyl]methyl}-3-(β-D-glucopyranosyl-oxy)-5-isopropyl-1*H*-pyrazole, and

pharmaceutically acceptable salts thereof.

12. A pyrazole derivative as claimed in claim 11, which is a compound selected from the following group:

3-(β-D-galactopyranosyloxy)-4-[(4-{3-[1-{[4-(2-hydroxy-ethyl)piperazin-1-yl]carbonyl}-1-(methyl)ethylcarbamoyl]-propyl}phenyl)methyl]-5-isopropyl-1*H*-pyrazole;

3-(β-D-galactopyranosyloxy)-5-isopropyl-4-{[4-(3-{1-

[(piperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}-propyl)phenyl]methyl}-1*H*-pyrazole;

3-(β-D-glucopyranosyloxy)-4-[(4-{3-[1-{[4-(2-hydroxyethyl)-piperazin-1-yl]carbonyl}-1-(methyl)ethylcarbamoyl]-propyl}-2-methylphenyl)methyl]-5-isopropyl-1*H*-pyrazole;

3-(β-D-galactopyranosyloxy)-5-isopropyl-4-{[4-(3-{1-[(4-methylpiperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}-propyl)phenyl]methyl}-1*H*-pyrazole;

3-(β-D-glucopyranosyloxy)-5-isopropyl-4-{[4-(2-{1-[(4-methylpiperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}-ethoxy)-2-methylphenyl]methyl}-1*H*-pyrazole;

3-(β-D-glucopyranosyloxy)-4-[(4-{2-[1-{[4-(2-hydroxyethyl)-piperazin-1-yl]carbonyl}-1-(methyl)ethylcarbamoyl]ethoxy}-2-methylphenyl)methyl]-5-isopropyl-1*H*-pyrazole;

3-(β-D-glucopyranosyloxy)-5-isopropyl-4-{[4-(2-{1-[(piperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}-ethoxy)-2-methylphenyl]methyl}-1*H*-pyrazole;

3-(β-D-glucopyranosyloxy)-5-isopropyl-4-{[4-(3-{1-[(piperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}-propyl)-2-methylphenyl]methyl}-1*H*-pyrazole;

3-(β-D-glucopyranosyloxy)-5-isopropyl-4-{[4-(3-{1-[(piperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}-propoxy)-2-methylphenyl]methyl}-1*H*-pyrazole;

3-(β-D-galactopyranosyloxy)-5-isopropyl-4-{[4-(3-{1-[(piperazin-1-yl)carbonyl]-1-(methyl)ethylcarbamoyl}-propoxy)-2-methylphenyl]methyl}-1*H*-pyrazole;

4-{[2-fluoro-4-(3-{1-[(piperazin-1-yl)carbonyl]-1-(methyl)-

ethylcarbamoyl}propyl)phenyl]methyl}-3-(β-D-galacto-pyranosyloxy)-5-isopropyl-1*H*-pyrazole, and pharmaceutically acceptable salts thereof.

13. A pharmaceutical composition comprising as the active ingredient a pyrazole derivative as claimed in any one of claims 1-11, or a pharmaceutically acceptable salt thereof together with a carrier or diluent.

14. A pharmaceutical composition as being a human SGLT1 inhibitor comprising as the active ingredient a pyrazole derivative as claimed in any one of claims 1-11, or a pharmaceutically acceptable salt thereof together with a carrier or diluent.

15. A pharmaceutical composition for inhibiting postprandial hyperglycemia comprising as the active ingredient a pyrazole derivative as claimed in any one of claims 1-11, or a pharmaceutically acceptable salt thereof together with a carrier or diluent.

16. A pharmaceutical composition for the prevention or treatment of a disease associated with hyperglycemia, which comprises as the active ingredient a pyrazole derivative as claimed in any one of claims 1-11, or a pharmaceutically acceptable salt thereof together with a carrier or diluent.

17. A pharmaceutical composition for the prevention or treatment as claimed in claim 16, wherein the disease associated with hyperglycemia is a disease selected from the group consisting of diabetes, impaired glucose tolerance, diabetic complications, obesity, hyperinsulinemia, hyperlipidemia, hypercholesterolemia, hypertriglyceridemia, lipid metabolism disorder, atherosclerosis, hypertension, congestive heart failure, edema, hyperuricemia and gout.

18. A pharmaceutical composition for the inhibition of advancing impaired glucose tolerance or impaired fasting glycemia into diabetes in a subject, which comprises as the active ingredient a pyrazole derivative as claimed in any one of claims 1-11, or a pharmaceutically acceptable salt thereof together with a carrier or diluent.

19. A pharmaceutical composition for the prevention or treatment of a disease associated with the increase of blood galactose level, which comprises as the active ingredient a pyrazole derivative as claimed in any one of claims 1-11, or a pharmaceutically acceptable salt thereof together with a carrier or diluent.

20. A pharmaceutical composition for the prevention or treatment as claimed in claim 19, wherein the disease associated with the increase of blood galactose level is galactosemia.

21. A pharmaceutical composition as claimed in claim 13, which is a sustained release formulation.

22. A pharmaceutical composition as claimed in any one of claims 15-21, which is a sustained release formulation.

23. A use of a pyrazole derivative as claimed in any one of claims 1-11, or a pharmaceutically acceptable salt thereof for the manufacture of a pharmaceutical composition for the prevention or treatment of a disease associated with hyperglycemia.

24. A use of a pyrazole derivative as claimed in any one of claims 1-11, or a pharmaceutically acceptable salt thereof for the manufacture of a pharmaceutical composition for the inhibition of advancing impaired glucose tolerance into diabetes in a subject.

25. A pharmaceutical combination which comprises (A) a pyrazole derivative as claimed in any one of claims 1-11, or a

pharmaceutically acceptable salt thereof, and (B) at least one member selected from the group consisting of an insulin sensitivity enhancer, a glucose absorption inhibitor, a biguanide, an insulin secretion enhancer, a SGLT2 inhibitor, an insulin or insulin analogue, a glucagon receptor antagonist, an insulin receptor kinase stimulant, a tripeptidyl peptidase II inhibitor, a dipeptidyl peptidase IV inhibitor, a protein tyrosine phosphatase-1B inhibitor, a glycogen phosphorylase inhibitor, a glucose-6-phosphatase inhibitor, a fructose-bisphosphatase inhibitor, a pyruvate dehydrogenase inhibitor, a hepatic gluconeogenesis inhibitor, D-chiroinsitol, a glycogen synthase kinase-3 inhibitor, glucagon-like peptide-1, a glucagon-like peptide-1 analogue, a glucagon-like peptide-1 agonist, amylin, an amylin analogue, an amylin agonist, an aldose reductase inhibitor, an advanced glycation endproducts formation inhibitor, a protein kinase C inhibitor, a γ-aminobutyric acid receptor antagonist, a sodium channel antagonist, a transcript factor NF-κB inhibitor, a lipid peroxidase inhibitor, an *N*-acetylated-α-linked-acid-dipeptidase inhibitor, insulin-like growth factor-I, platelet-derived growth factor, a platelet-derived growth factor analogue, epidermal growth factor, nerve growth factor, a carnitine derivative, uridine, 5-hydroxy-1-methylhidantoin, EGB-761, bimoclomol, sulodexide, Y-128, antidiarrhoics, cathartics, a hydroxymethylglutaryl coenzyme A reductase inhibitor, a fibric acid derivative, a β_3-adrenoceptor agonist, an acyl-coenzyme A cholesterol acyltransferase inhibitor,

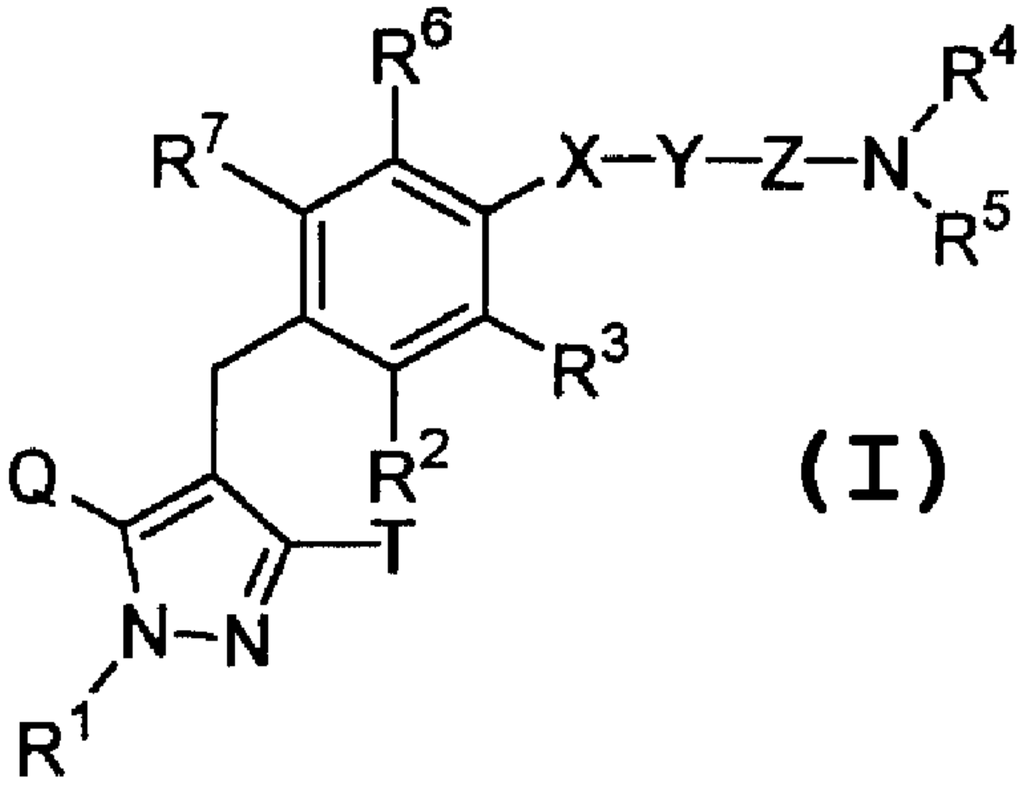
probcol, a thyroid hormone receptor agonist, a cholesterol absorption inhibitor, a lipase inhibitor, a microsomal triglyceride transfer protein inhibitor, a lipoxygenase inhibitor, a carnitine palmitoyl-transferase inhibitor, a squalene synthase inhibitor, a low-density lipoprotein receptor enhancer, a nicotinic acid derivative, a bile acid sequestrant, a sodium/bile acid cotransporter inhibitor, a cholesterol ester transfer protein inhibitor, an appetite suppressant, an angiotensin-converting enzyme inhibitor, a neutral endopeptidase inhibitor, an angiotensin II receptor antagonist, an endothelin-converting enzyme inhibitor, an endothelin receptor antagonist, a diuretic agent, a calcium antagonist, a vasodilating antihypertensive agent, a sympathetic blocking agent, a centrally acting antihypertensive agent, an α_2-adrenoceptor agonist, an antiplatelets agent, a uric acid synthesis inhibitor, a uricosuric agent and a urinary alkalinizer.

26. A use of (A) a pyrazole derivative as claimed in any one of claims 1-11, or a pharmaceutically acceptable salt thereof, and (B) at least one member selected from the group consisting of an insulin sensitivity enhancer, a glucose absorption inhibitor, a biguanide, an insulin secretion enhancer, a SGLT2 inhibitor, an insulin or insulin analogue, a glucagon receptor antagonist, an insulin receptor kinase stimulant, a tripeptidyl peptidase II inhibitor, a dipeptidyl peptidase IV inhibitor, a protein tyrosine phosphatase-1B inhibitor, a glycogen phosphorylase inhibitor, a glucose-6-phosphatase inhibitor, a fructose-bisphosphatase inhibitor, a pyruvate dehydrogenase inhibitor, a hepatic gluconeogenesis inhibitor, D-chiroinsitol, a glycogen synthase kinase-3 inhibitor, glucagon-like peptide-1, a glucagon-like peptide-1 analogue, a glucagon-like peptide-1 agonist, amylin, an amylin analogue, an amylin agonist, an aldose reductase inhibitor, an advanced glycation endproducts formation inhibitor, a protein kinase C inhibitor, a γ-aminobutyric acid receptor antagonist, a sodium channel antagonist, a transcript factor NF-κB inhibitor, a lipid peroxidase inhibitor, an *N*-acetylated-α-linked-acid-

dipeptidase inhibitor, insulin-like growth factor-I, platelet-derived growth factor, a platelet-derived growth factor analogue, epidermal growth factor, nerve growth factor, a carnitine derivative, uridine, 5-hydroxy-1-methylhidantoin, EGB-761, bimoclomol, sulodexide, Y-128, antidiarrhoics, cathartics, a hydroxymethylglutaryl coenzyme A reductase inhibitor, a fibric acid derivative, a β_3-adrenoceptor agonist, an acyl-coenzyme A cholesterol acyltransferase inhibitor, probcol, a thyroid hormone receptor agonist, a cholesterol absorption inhibitor, a lipase inhibitor, a microsomal triglyceride transfer protein inhibitor, a lipoxygenase inhibitor, a carnitine palmitoyl-transferase inhibitor, a squalene synthase inhibitor, a low-density lipoprotein receptor enhancer, a nicotinic acid derivative, a bile acid sequestrant, a sodium/bile acid cotransporter inhibitor, a cholesterol ester transfer protein inhibitor, an appetite suppressant, an angiotensin-converting enzyme inhibitor, a neutral endopeptidase inhibitor, an angiotensin II receptor antagonist, an endothelin-converting enzyme inhibitor, an endothelin receptor antagonist, a diuretic agent, a calcium antagonist, a vasodilating antihypertensive agent, a sympathetic blocking agent, a centrally acting antihypertensive agent, an α_2-adrenoceptor agonist, an antiplatelets agent, a uric acid synthesis inhibitor, a uricosuric agent and a urinary alkalinizer, for the manufacture of a pharmaceutical composition for the prevention or treatment of a disease associated with hyperglycemia.

27. A use of (A) a pyrazole derivative as claimed in any one of claims 1-11, or a pharmaceutically acceptable salt thereof, and (B) at least one member selected from the group consisting of an insulin sensitivity enhancer, a glucose absorption inhibitor, a biguanide, an insulin secretion enhancer, a SGLT2 inhibitor, an insulin or insulin analogue, a glucagon receptor antagonist, an insulin receptor kinase stimulant, a tripeptidyl peptidase II inhibitor, a dipeptidyl peptidase IV inhibitor, a protein tyrosine phosphatase-1B inhibitor, a glycogen phosphorylase inhibitor, a glucose-6-phosphatase inhibitor, a fructose-bisphosphatase inhibitor, a pyruvate dehydrogenase inhibitor, a hepatic gluconeogenesis inhibitor, D-chiroinsitol, a glycogen synthase kinase-3 inhibitor, glucagon-like peptide-1, a glucagon-like peptide-1 analogue, a glucagon-like peptide-1 agonist, amylin, an amylin analogue, an amylin agonist, an aldose reductase inhibitor, an advanced glycation endproducts formation inhibitor, a protein kinase C inhibitor, a γ-aminobutyric acid receptor antagonist, a sodium channel antagonist, a transcript factor NF-κB inhibitor, a lipid peroxidase inhibitor, an *N*-acetylated-α-linked-acid-dipeptidase inhibitor, insulin-like growth factor-I, platelet-derived growth factor, a platelet-derived growth factor analogue, epidermal growth factor, nerve growth factor, a carnitine derivative, uridine, 5-hydroxy-1-methylhidantoin, EGB-761, bimoclomol, sulodexide, Y-128, antidiarrhoics, cathartics, a hydroxymethylglutaryl coenzyme A reductase

inhibitor, a fibric acid derivative, a β_3-adrenoceptor agonist, an acyl-coenzyme A cholesterol acyltransferase inhibitor, probcol, a thyroid hormone receptor agonist, a cholesterol absorption inhibitor, a lipase inhibitor, a microsomal triglyceride transfer protein inhibitor, a lipoxygenase inhibitor, a carnitine palmitoyl-transferase inhibitor, a squalene synthase inhibitor, a low-density lipoprotein receptor enhancer, a nicotinic acid derivative, a bile acid sequestrant, a sodium/bile acid cotransporter inhibitor, a cholesterol ester transfer protein inhibitor, an appetite suppressant, an angiotensin-converting enzyme inhibitor, a neutral endopeptidase inhibitor, an angiotensin II receptor antagonist, an endothelin-converting enzyme inhibitor, an endothelin receptor antagonist, a diuretic agent, a calcium antagonist, a vasodilating antihypertensive agent, a sympathetic blocking agent, a centrally acting antihypertensive agent, an α_2-adrenoceptor agonist, an antiplatelets agent, a uric acid synthesis inhibitor, a uricosuric agent and a urinary alkalinizer, for the manufacture of a pharmaceutical composition for the inhibition of advancing impaired glucose tolerance into diabetes in a subject.



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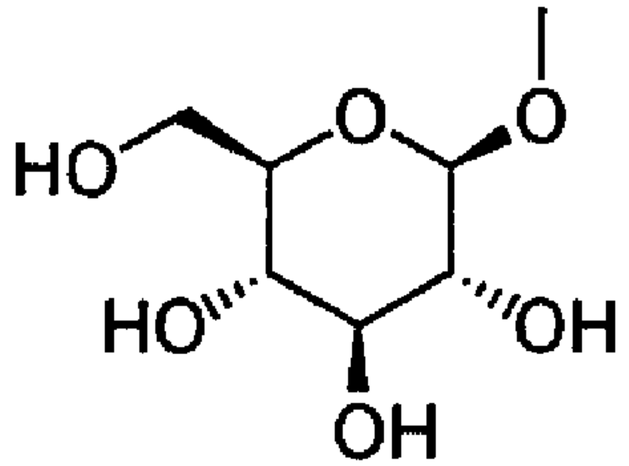

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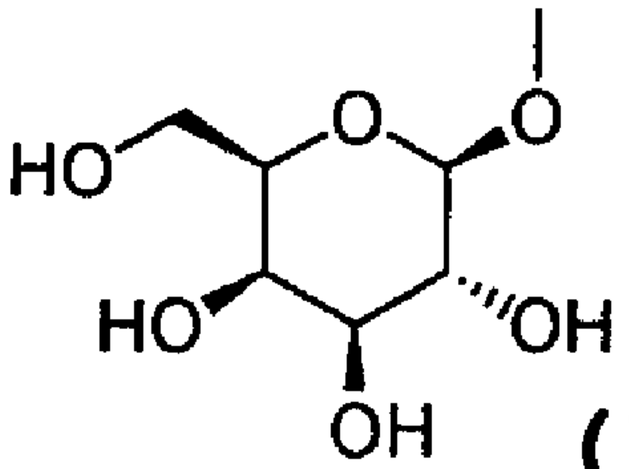

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