

(72) , 12
 , , 12
 , 12
 , , , 12
 , , 44
 , 12
 , 74 , 10 ()
 , 12
 , 129 9

(74)
 :

(54) 2 - (- 9 -) - - 3,4 -

R^1, R^2, R^3

| , ,
 .

, ,

, , .

가

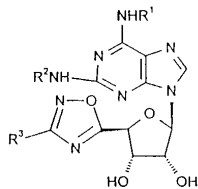
(,)

(,)

A2a 가 (Kronstein) (1994) 가 (1983 1985),
 A2 (Berkey) (Webster) (1993), (Richter) (1992), (Skubitz) (1988). A2b
 A2a (CGS21680)가 A2a
 (Dianzani) , 1994).
 (Elliot) (Leonard) (1989), (Peachell) (1989).
 (methotrexate) 가 A2
 (Asako) (1993), (1993 1994)). 가
 (Green) (1991), (Rosengren) (1995)).
 가 가 (Hirschorn) (1993)).

2a
 가

A3 가 (,) A3 가 A3 가 A2a -
 (1996)). (Kohno) (1996), (Van Schaik) (1996)).
 A3 (



, R¹ R²

(i) C₃₋₈ - ,

(ii) ,

(iii) $\text{-CH}_2\text{CHCH}_2\text{-}$,

(iv) C_{3-8} C_{1-6} - ,

(v) C_{1-8} - ,

(vi) C_{1-6} - ,

(vii) $\text{R}^4\text{R}^5\text{N-C}_{1-6}$ - ,

(viii) C_{1-6} $\text{-CH(CH}_2\text{OH)-}$,

(ix) C_{1-5} $\text{-CH(CH}_2\text{OH)-}$,

(x) C_{1-5} $\text{-C(CH}_2\text{OH)}_2\text{-}$,

(xi) $(\text{-CH}_2\text{-})_p\text{R}^6$ C_{3-8} - ,

(xii) $\text{H}_2\text{NC(=NH)NHC}_{1-6}$ - ,

(xiii) $\text{-}\begin{matrix} \text{(CH}_2\text{)}_a \\ \text{(CH}_2\text{)}_b \end{matrix}\text{-}$ X
 가

(xiv) -C_{1-6} -OH ,

(xv) -C_{1-8} - ,

(xvi) $\text{-}\begin{matrix} \text{(CH}_2\text{)}_a\text{CO(CH}_2\text{)}_b \\ \text{(CH}_2\text{)}_c \end{matrix}\text{-NR}^7$ - ,

(xvii) - ,

(xviii) $\text{-(CH}_2\text{)}_f\text{SO}_2\text{NH}_g(\text{C}_{1-4}\text{-})_{2-g}$ $\text{- (CH}_2\text{)}_f\text{SO}_2\text{NH}_g(\text{C}_{1-4}\text{-})_{2-g}$

R^3 -CH=CH_2 , $n\text{-}$, $\text{-CH}_2\text{CH=CH}_2$, -CH=CHCH_3 ,
 -CH(OH)CH_3 , $\text{-(CH}_2\text{)}_q$, $\text{-(CH}_2\text{)}_h\text{Y(CH}_2\text{)}_i\text{H}$, $\text{-COO(CH}_2\text{)}_l\text{H}$, $\text{-CON(CH}_2\text{)}_m\text{H((CH}_2\text{)}_n\text{H)}$, $\text{-CO(CH}_2\text{)}_o\text{H}$
 $\text{-C((CH}_2\text{)}_u\text{H)=NO(CH}_2\text{)}_v\text{H}$

$\text{Y O, S N(CH}_2\text{)}_j\text{H}$ - ,

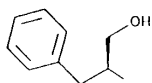
a b 0 4 - , $a + b$ 3 5 - ,

c, d e 0 3 - , $c + d + e$ 2 3 - ,

f 2 3 - , g 0 2 - ,

R¹ R² C₁₋₆ - CH(CH₂OH) - Me₂CHCH(CH₂OH) - 가 .

R¹ R² C₁₋₅ - CH(CH₂OH) - PhCH₂CH(CH₂OH) - 가 .



R¹ R² C₁₋₅ - C(CH₂OH)₂ - PhCH₂C(CH₂OH)₂ - 가 .

R¹ R² (, 1, 2 3) - (CH₂)_pR⁶ C₃₋₈ 2 -
 - (-2- -) 4 - (-4- -)

R¹ R² H₂NC(=NH)NHC₁₋₆ H₂NC(=NH)NH(CH₂)₂ - 가 .

R¹ R² -3- , -3- , -4- ,
 -1,1- -3- , -4- , -4- 1,1- -
 -1.6- -4- , 가 C₁₋₆ (,) , C₁₋₆ (,) , C₁₋₆ -
 (,) 가 .

R¹ R² - C₁₋₆ - OH - CH₂CH₂OH - CH(CH₂OH)CH(CH₃)₂ 가 .

R¹ R² C₁₋₈ - CH₂CH₂Cl (CH₃)₂ClC(CH₂)₃ - .

R¹ R² 2- -4- , 2- -3-
 가 C₁₋₆ (,) 가 .

R¹ R² (, , 4-) .

R¹ R² - (CH₂)_fSO₂NH_g(C₁₋₄)_{2-g} - (CH₂)₂SO₂NHMe - (CH₂)₂SO₂NHCH₂Ph .

R⁷ C₁₋₆ , R⁷ C₁₋₆ , R⁷ -COC₁₋₆

R¹ R² 가 가 .

R¹ C₁₋₈ , C₃₋₈ C₁₋₆ - , C₁₋₆ - .

R² 가 -CH(CH₂OH)C₁₋₃ , 4- (-3-) CH₂CH₂ - (
 1-C₁₋₃ -1H- -4-) .

R² 가 C₁₋₆ N- -3- , R⁴R⁵NC₁₋₆ , C₁₋₆ -OH, (
) , C₁₋₅ -CH(CH₂OH)- , C₃₋₈ , (CH₂)₂(
 -2-) , 1H- -4- ,) (, 1, 2 3)
 - (CH₂)_pR⁶ C₃₋₈ .

R³ , n- , n- , -CH₂OH, -COOCH₃ - -CH="NOH,"
 , n- , -CH₂OH .

R³ , n- , 가 ,
 , 가 .

R⁴ R⁵ 가 , C₁₋₆ , , C₁₋₆ - , NR⁴R⁵ 가 , ,
 , , N-C₁₋₆ .

R⁴ R⁵ 가 , NR⁴R⁵ 가 , , ,
 , N- .

p가 0 . R⁶ OH NH₂ .

q가 1 . h가 1 . i가 0 . j가 1 . l 1
 . m n 0 . o가 1 . u가 0 . v가 0
 . Y가 0 .

a가 2 b가 1 2 . X가 NR⁷ (, NH), O, S SO₂, O, S NH
 .

c가 0 , d가 1 e가 1 d가 0 e가 2 . R⁷ .

R¹ Ph₂CHCH₂ - .
 , R¹ CH(CH₂CH₃)₂, , , - (CH₂)₂C(CH₃)₃ .

R² 가 -CH(CH₂OH)CH(CH₃)₂ (1S- -2- -), -4- - , 2-(1-
 -1H- -4-)CH₂CH₂ - -3- .
 , R² 가 2-(1H- -4-) , -1- , -1- , -2- , (±)-
 -2- , 3,4- , 2- , 4- , N- -3- ,
 -2- , 1S- -2- , , -1- 2- (-2-) .

R¹ Ph₂CHCH₂ -, -CH(CH₂CH₃)₂, , R² 가 2-(1- -1H-
 -4-)CH₂CH₂ -, 1S- -2- , 1S- -2- -

가 l
 (2R,3R,4S,5S) -2- {6-(2,2- -) -2- [2-(1- -1H- -4-)-]- -
 9- } -5- (3- -[1,2,4] -5-)- -3,4- ,

(2S,3S,4R,5R) -2- (3- -[1,2,4] -5-) -5- {6-(1- -) -2- [2-(1- -1H
 -4-)-]- -9- }- -3,4- ,

(2R,3R,4S,5S) -2- {6-(1- -) -2- [2-(1- -1H- -4-)-]- -9
 - } -5- (3- -[1,2,4] -5-)- -3,4- ,

(2R,3R,4S,5S) - 2 - {6 - (2,2 -) - 2 - [2 - (1 - - 1H - - 4 -) -] - 9 - } - 5 - (3 - - [1,2,4] - 5 -) - - 3,4 - ,

(2R,3R,4S,5S) - 2 - {6 - - 2 - [2 - (1 - - 1H - - 5 -) -] - - 9 - } - 5 - (3 - - [1,2,4] - 5 -) - - 3,4 - ,

(2R,3R,4S,5S) - 2 - [6 - - 2 - (1S - - 2 - -) - - 9 -] - 5 - (3 - - [1,2,4] - 5 -) - - 3,4 - ,

(2R,3R,4S,5S) - 2 - (6 - - 2 - - - 9 -) - 5 - (3 - - [1,2,4] - 5 -) - - 3,4 - ,

(2S,3S,4R,5R) - 2 - (3 - - [1,2,4] - 5 -) - 5 - [6 - (1 - -) - 2 - (2 - (1 - - 1H - - 4 -) -) - - 9 -] - - 3,4 - ,

(2R,3R,4S,5S) - 2 - {6 - - 2 - [2 - (1 - - 1H - - 4 -) -] - - 9 - } - 5 - (3 - - [1,2,4] - 5 -) - - 3,4 - ,

(2R,3R,4S,5S) - 2 - [6 - (2,2 - -) - 2 - (1S - - 2 - -) - - 9 -] - 5 - (3 - - [1,2,4] - 5 -) - - 3,4 - ,

(2R,3R,4S,5S) - 2 - [6 - (1 - -) - 2 - (1S - - 2 - -) - - 9 -] - 5 - (3 - - [1,2,4] - 5 -) - - 3,4 -

I
()
I

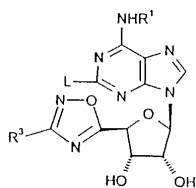
II

I

1

R²NH₂

II



, L

DMSO

50

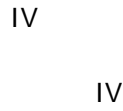
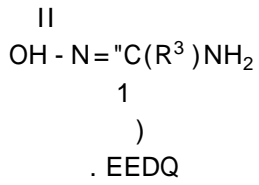
150

가

II
R²NH₂

2

가



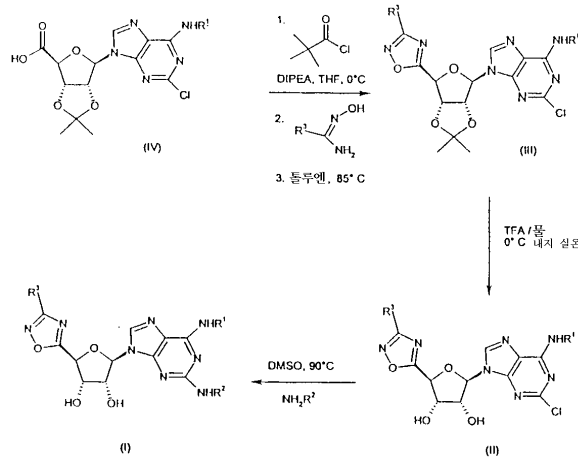
20 150
 3 (,

가

, 0 150

1

1



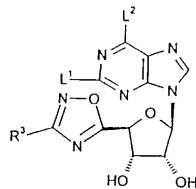
L ()

III IV 2 가 가 ,

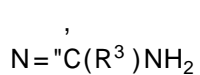
IV WO 94/17090 4 (Flora) (1978)
 (Bedford) (1986)

, II V $\text{R}^1 \text{NH}_2$

V



, L¹ L² (,)
 (, 50) (,)



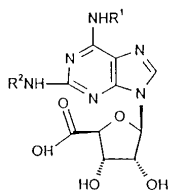
VI

(, EEDQ)
2

OH -

50 150

VI



VII

VI

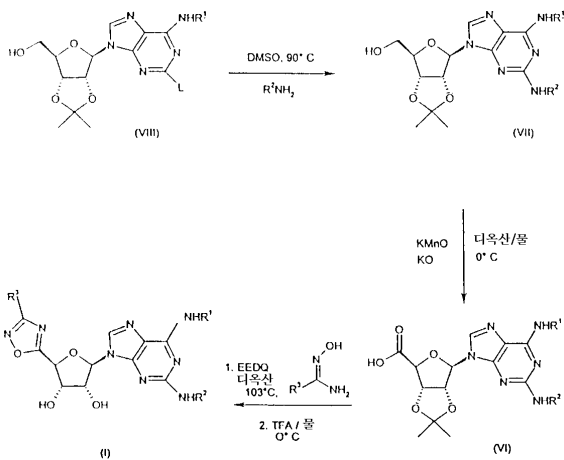
0 50

VII

0 50 TEMPO

2

2



L ()

DMSO

VII

50 150

VIII

R^2NH_2

R^2NH_2

VIII

WO94/19070

3 ($R^1 = Ph_2CHCH_2 -$)

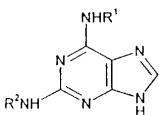
I

3

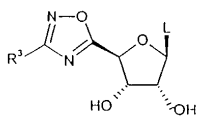
IX

X

IX



X



, L

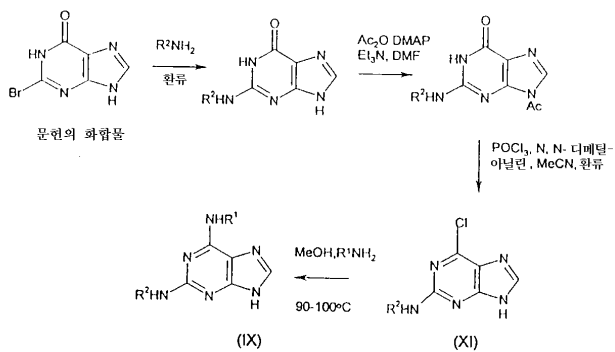
L OH 2- 3- 가 C₁₋₆ L (, X), (,)
 TMSOTf) DBU . MeCN (,)

R²NH 가 L IX II
 V

IX ()

, VIII 3

3



X

III

R¹NH₂

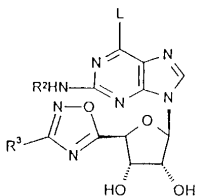
1

I

4

IIa

IIa



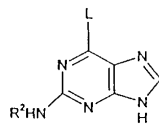
, L (,) .

Ila 3

XI1

X

XI1



XI1

3

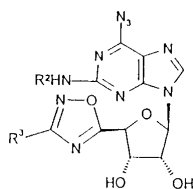
, R¹

I Ib

5

PPh₃

I Ib



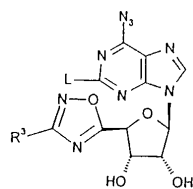
I Ib

1

Va

R²NH₂

Va



Va

L¹ L² 가
NaN₃

, (,) V

I

I

6

I

R¹NH₂, R²NH₂ OH - N=C(R³)NH₂

(J Wiley and Sons, 1991)

[" Protective Groups in Organic Synthesis"

가 (,

), (,) (,) , 가

(1) 2a, 1 3 .

(CHO) (Castanon) (Spevak) (1994)
 , CHO , (SPAP) AMP
 (, 1995). SPAP cAMP (A2a)
 - cAMP (A1 A3) , EC₅₀
 N - (NECA) .

(2)

(mepyramine, 1 mg/kg ip)
 (50 µg/ml 30)
 (30) . 24 ,
 (ED₅₀) (Sanjar) , 1992). 50%

< >

H, (Wolf), RE, (Granger), DN [Gastroenterology 104, pp 31 - 37 (1993)],
 CD, (Howd RA), (Dailey OD), (Miller A), (Nolen HW III), (Kenley RA),
 (Kern JR), (Winterle JS) [J. Med. Chem. 29, pp 2174 - 2183 (1986)],
 TH, , RO [Biochem. Biophys Acta 1175, pp 312 - 318 (1993)],
 MJ, W [Biochem. Biophys Res. Commun. 198, pp 626 - 631 (1994)],
 BN, (Kramer SB), (Weissmann G), R [Trans. Assoc. Am. Physicians 9
 6, pp 384 - 91 (1983)],
 (1985)], (Rosenstein ED), , [Ann N.Y. Acad. Sci. 451, pp 291 - 301
 (1985)],
 , (Naime D), (Ostad E) [J. Clin. Invest. 92, pp 2675 - 82 (1993)],
 , , [Adv. Exp. Med. Biol., 370, pp 411 - 6 (1994)],
 [J. Appl. Physiol. 76, pp 5 - 13 (1994)],
 C, (Brunelleschi S), (Viano I), (Frantozzi R) [Eur. J. Pharmacol 26
 3, pp 223 - 226 (1994)],
 KRF, EJ [FEBS Letters 254, pp 94 - 98 (1989)],
 KP, (Van't Riet B), (Wampler GL) [Cancer Research, 38, pp 1291 - 1295 (1978)
],
 PG, (Basbaum AI), (Helms C), (Levine JD) [Proc. Natl. Acad Sci. 88, pp 4162 -
 4165 (1991)],

[Pediatr. Res 33, pp S35 - 41 (1993)],

Y, (Xiao - duo J), (Mawhorter SD), (Koshiba M), (Jacobson KA)
[Blood 88, p 3569 - 3574 (1996)],

PT, (Lichtenstein LM), (Schleimer RP) [Biochem Pharmacol 38, pp 1717 - 1725 (1989)],

J [J. Leukocyte Biol. 51, pp 270 - 275 (1992)],

S, (Bong GW), (Firestein GS) [J. Immunol. 154, pp 5444 - 5451 (1995)],

S, (McCabe PJ), (Fattah D), (Humbles AA), (Pole SM) [Am. Rev. Respir. Dis. 145, A40 (1992)],

(Skubiz KM), (Wickman KA), (Hammerschmidt DE) [Blood 72, pp 29 - 33 (1988)],

(Van Schaick EA), (Ijzerman AP), (Danhof M.) [Eur J Pharmacol 308 p311 - 314 (1996)],

(Wood KV) [Curr Opinion Biotechnology 6 p50 - 58 (1995)]

< >
(Merck Art) 9385) 0.040 0.063 mm 가 가
(Biotage)' 20 p.s.i. 5 p.s.i. 가 가
(TLC) (5719) 40 가 5 x 10 cm
60 F₂₅₄ TLC
HPLC (0.1%) (0.1%
) C18 - (1" (Dynamax:))

< HPLC >
(HPLC) i) 0.1% ii) 0.05
(4 ml ii)
(Supelco:) ABZ+ 5µm 100mm x 22mm
, 20 5 95%

< LC/MS >
/ (LC/MS)

LC/MS A - () ABZ+, 3.3cm x 4.6mm , A - 0.1% v/v + 0.0
 77% w/v B - 95:5 : + 0.05% v/v . 0.7 100%
 A, A + B , 3.5 0 100% B , 3.5 100% B , 0.3 0%
 B 가 . 가 .

LC/MS B - () ABZ+, 5cm x 2.1mm , A - 0.1% v/v + 0.077
 % w/v B - 95:5 : + 0.05% v/v . 3.5 0
 100% B, 1.50 100% B , 0.05 0% B 가 .
 가 .

LC/MS C - () ABZ+, 3.3cm x 4.6mm , A - 0.1% v/v + 10m
 mol B - 95:5 : + 0.05% v/v . 0.7 100% A,
 A + B , 3.7 0 100% B , 0.9 100% B , 0.2 0%
 B 가 . 가 .

< >

1: (6R - {6 - (2,2 - -) - 2 - [2 - (1 - - 1H - - 4 -

) -] - - 9 - } - 2,2 - - - (3aR,6aR) - [3,4 - d][1,3] - 4R -) -

2 - - N - (2,2) - 2,3,0 - (1 -) - (0.20 g, 0.384 mmol) [W
 O 94/17090 3] 2 - (1 - - 1H - - 4 -) (0.24 g, 1.92 mmol,
 -) 가 ,
 . DMSO (0.7 ml) 가 , 90 25 가
 (200:5:1 200:10:1, DCM:MeOH:NH₃)
 (0.226 g) .

LC/MS A R_t = "3.97" ,m/z = "611" MH⁺

2: (3aS,4S,6R,6aR) - 6 - {6 - (2,2 - -) - 2 - [2 - (1 - - 1H - - 4 -) -
] - - 9 - } - 2,2 - - - [3,4 - d][1,3] - 4 -

1,4 (3 ml) (1 ml) 1(0.226 g, 0.370 mmol) 0 (1 ml)
 (0.292 g, 1.85 mmol) (0.166 g, 2.96 mmol) 가 .
 0 3 ,
 (2N) pH 3 , (3 x 20ml)
 (20 ml) , (MgSO₄) , (0.100 g)

LC/MS A R_t = "3.96" ,m/z = "625" MH⁺

3: {2 - - 9 - [6S - (3 - - [1,2,4] - 5 -) - 2,2 - - - (3aR,6aS) -
 [3,4 - d][1,3] - 4R -] - 9H - - 6 - } - (2,2 - -) -

6R,6aR) - 6 - [2 - (0.218 g, 1.214 mmol) 0 (10 ml) (3aS,4S, [3,4 - d][1,3] - 4 - (2,2 - (0.50 g, 0.935 mmol) [WO 94/17090 4] 가 (0.150 ml, 1.214 mmol) 가 , 0 1 (0.160 g, 1.87 mmol) 가 , 1 (3 ml) N - 가 , 20 (15 ml) , 1 80 가 (2 x 10 ml) (35 50% (0.430 g)

TLC (35%) rf = "0.58

4: (2R,3R,4S,5S) - 2 - [2 - (2,2 - (2,2 - (1,2,4) - 5 -) - - 3,4 -

8.5 5 10 (5.6 ml) (1.4 ml) 3(0.375 mg, 0.638 mmol) (0.340 mg) (2X)

LC/MS B R_t = "3.36" ,m/z = "548" MH⁺

5: 2 - N - (1 -) -

2,6 - (2,3,5 - O - D -) - 9H - (10.1 g, 22.6 mM) ((M.J. Robins) (B. Uznanski) [Canad, J. Chem., 1981, 59(17), 2608]), (300 ml), K₂CO₃ (5 g) 1 - (2.17 g, 24.84 mM) 24 20 54 73 가 (50 ml) 가 , (3 x 80 ml) (MgSO₄) (9.44 g) . LC/M S A R_t = "2.66" ,m/z = "372" MH⁺

6: {6R - [2 - (1 - (3aR,6aR) - [3,4 - d][1,3] - 4R - } - - 9 -] - 2,2 -

5(9.3 g, 22.6 mmol), 2,2 - (35 ml), (250 ml) - (8.1 g) 20 22 , (200 ml) , (, , 3 x 70 ml) (50 ml) (MgSO₄) , (50%, 60% 70%) (5.67 g) . TLC SiO₂(50%) R_f = "0.17

7: (3aS,4S,6R,6aR) - 6 - [2 - (1 - (3,4 - d][1,3] - 4 - - 9 -] - 2,2 -

(250 ml) NaHCO₃ (138 ml) 6(5.43¹ g, 13.2 mmol), KBr (0.157 g, 1.32 mmol), TEMPO (0.010 g, 0.07 mmol) 0 20 (13 % , 7.3 ml), NaHCO₃(0.420 g) (2 ml) 5 가 .30 , (KBr, TEMPO, , NaHCO₃) 가 .30 , (100 ml) , Na₂SO₃(28 g) , (100 ml) , (3 x 200 ml) , (MgSO₄) , 2M pH 3 , (5.03 g) . LC/MS B Rt="3.25" ,m/z="426" MH+

8: {2 - -9 - [6S - (3 - - [1,2,4] -5 -) -2,2 - - (3aR,6aS) - [3,4 - d][1,3] -4R -] -9H - -6 - } - (1 - -) -

(12 ml) 7(0.7 g, 1.647 mmol) 0 (0.372 ml, 2.14 mmol) (0.263 ml, 2.14 mmol) 0 1.5 , -10 , N - - (0.289 g, 3.29 mmol) 15 (5 ml) 가 . 0 5 1 , 20 . (35% -) (0.780 g) .

TLC SiO₂ (30%) Rf = "0.26"

LC/MS B Rt="3.53" ,m/z="478" MH⁺

9: (2R,3R,4S,5S) -2 - [2 - -6 - (1 - -) - -9 -] -5 - (3 - - [1,2,4] -5 -) - -3,4 -

/ (10:1, 5 ml) 8(0.78 g, 1.63 mmol) 0 4.5 (3 x 10 ml) (0.705 g) . LC/MS B Rt="3.05" ,m/z="438" MH+

10: {2 - -9 - [2,2 - -6S - (3 - - [1,2,4] -5 -) - - (3aR,6aS) - [3,4 - d][1,3] -4R -] -9H - -6 - } - (1 - -) -

(12 ml) 7(0.7 g, 1.647 mmol) 0 (0.372 ml, 2.14 mmol) (0.263 ml, 2.14 mmol) 0 1.5 , -10 , N - - (0.244 g, 3.29 mmol) 15 (5 ml) 가 . 0 5 1 , 20 . (2 x 20 ml) . (15 ml) , 80 1 가 . , (35% -) (0.762 g) . TLC SiO₂(30%) Rf = "0.24." LC/MS B Rt="3.41" ,m/z="464" MH+

11: (2R,3R,4S,5S) -2 - [2 - -6 - (1 - -) - -9 -] -5 - (3 - - [1,2,4] -5 -) - -3,4 -

/ (10:1) (5 ml) 10(0.76 g, 1.64 mmol) 0 4.5 (3 x 10 ml) (0.692 g) . LC/MS B Rt="2.92" ,m/z="424" MH+

12: 2 -

(15 ml) 0 30 (5 ml) 2,6 -
 - 9 - (2,3,5 - - O - - - D -) - 9H - (2.000 g, 4.5 mmol) (
 [Canad, J. Chem., 1981, 59(17), 2608]) 가 , 24 20 가 . 6
 20 가 ,
 () (1.152
 g) . TLC SiO₂() Rf ="0.15

13: [6R - (6 - - 2 - - - 9 -) - 2,2 - - - (3aR,6aR) - [3,4 - d][1,3
] - 4R -] -

(70 ml) 12(0.700 g, 2.3 mmol) 2,2 - (1.70 m, 13.8 mmol)
 - (0.438 g, 2.3 mmol) 가 , 20
 , (150 ml) (, , 3 x 50 ml)
 (50 ml) (MgSO₄) ,
 (0.651 g)

TLC SiO₂ () Rf ="0.33

14: (3aS,4S,6R,6aR) - 6 - (6 - - 2 - - - 9 -) - 2,2 - - - [3,4 - d]
 [1,3] - 4 -

1,4 - (12 ml) (4 ml) 13(0.400 g, 1.2 mmol) 0 20 (4 ml)
 KMnO₄(0.924 g, 5.8 mmol) (0.524 g, 9.4 mmol) 가 . 0
 3 가 , 2N HCl pH 3
 (3 x 50 ml) , (MgSO₄)
 4) , (0.316 g)

TLC SiO₂ () Rf ="0.10

15: 2 - - 9 - [2,2 - - 6S - (3 - - [1,2,4] - 5 -) - - (3aR,6aS) -
 [3,4 - d][1,3] - 4R -] - 9H - - 6 -

(10 ml) 14(0.400 g), (0.154 ml) 15
 , 0 (0.18 ml) 가 , 0 1
 N - - (0.196 g) , 0 1
 가 . (20 ml) 가 , 80 3 가
 . [: :880 (100:8:1)]
 (0.328 g)

TLC SiO₂ (: :880 NH₃ 100:8:1) Rf ="0.47

16: 2 - - 9 - [6S - (3 - - [1,2,4] - 5 -) - 2,2 - - - (3aR,6aS) -
 [3,4 - d][1,3] - 4R -] - 9H - - 6 -

15 (10 ml) 14(0.500 g), (0.318 ml) 0
 (0.225 ml) 가 , 0 1
 (2 ml) N- (0.246 g) , 0 1
 가 . : :880
 (100:8:1)
 (0.389 g)

TLC SiO₂ (: :880 NH₃ 100:8:1) Rf = "0.5

17: (2R,3R,4S,5S) - 2 - (6 - - 2 - - 9 -) - 5 - (3 - - [1,2,4] - 5 -) -
 - - 3,4 -

(20 ml) (5 ml) 15(0.488 g) 100 16 가 .
 (0.537 g)

TLC SiO₂ (: :880 NH₃ 100:8:1) Rf = "0.14

18: (2R,3R,4S,5S) - 2 - (6 - - 2 - - 9 -) - 5 - (3 - - [1,2,4] - 5 -) -
 - - 3,4 -

(15 ml) (3 ml) 16(0.381 g) 100 4.5 가 , 119 3
 가 (5 ml) (1 ml) 가 , 119 8 가 .
 (0.410 g)

TLC SiO₂ (: :880 NH₃ 100:8:1) Rf = "0.15

19: [6R - (6 - - 2 - - 9 -) - 2,2 - - (3aR,3aR) - [3,4
 - d][1,3] - 4R -] -

13(10.0 g, 19.5 mmol) (12.2 ml, 97.3 mmol) 110 7 가
 (400 ml) , 1M HCl (3 x
 200 ml) 5%
 (7.61 g)

TLC SiO₂ (: 10:1) Rf = "0.28

20: (3aS,4S,6R,6aR) - 6 - (6 - - 2 - - 9 -) - 2,2 - -
 [3,4 - d][1,3] - 4 -

1,4 - (54 ml) (13.3 ml) 19(4.0 g, 9.38 mmol) 0 30 (84 ml)
 KMnO₄(7.5 g, 46.9 mmol) (4.24 g, 75 mmol) 가 0
 1 가 KMnO₄ ,
 , 1,4 - 가 가 20 ml ,
 HCl , P₂O₅ (2.
 25 g)

TLC SiO₂ (: 5:1) Rf = "0.44

21: 2 - - 9 - [6S - (3 - - [1,2,4] - 5 -) - 2,2 - - (3aR,6
 aS) - [3,4 - d][1,3] - 4R -] - 9H - - 6 -

DMF (10 ml) 20(0.500 g, 1.14 mmol) N- (0.168 g, 2.28 mmol) EEDQ
 (0.654 g, 2.28 mmol) 가 , 2 가 . N- (0.168 g, 2.28 mmol)
 mmol) EEDQ (0.654 g, 2.28 mmol) 가 , 4 가 ,
 , 5%
 (0.256 g)

TLC SiO₂ (: 19:1) Rf = "0.33

22: {2- -9-[2,2- -6R-(3- -[1,2,4] -5-)}

- (3aS,6aR) - [3,4-d][1,3] -4S-]-9H- -6- }-(2,2-)-

(0.181 ml, 1.04 mmol) 0 (8 ml) (3aS,4S,
 6R,6aR) -6-[2- -6-(2,2- -)- -9-]-2,2- - [3,4-d][
 1,3] -4- (0.428 g, 0.8 mmol) [WO 94/17090 4] 가
 . (0.128 ml, 1.04 mmol) 가 , 0 1
 (7 ml) N- - (0.163 g, 1.6 mmol) 10 가 ,
 0 1 가 , 20
 , (2 x 10 ml) . (15 ml) , 1
 80 가 . (40%
 -) (0.392 g)

LC/MS A R_t = "5.27" , m/z = "602" MH⁺

23: (2R,3R,4S,5S) -2-[2- -6-(2,2- -)- -9-]-5-(3- -[1,2,4]
 -5-)- -3,4-

(10 ml) (2.5 ml) 22(0.392 g, 0.652 mmol) 100 26
 (2 x 10 ml)

(0.355 g)

LC/MS B R_t = "3.41" , m/z = "562" MH⁺

24: {2- -9-[2,2- -6S-(3- -[1,2,4] -5-)- - (3aR,6aS) -
 [3,4-d][1,3] -4R-]-9H- -6- }-(2,2-)-

(0.063 ml, 0.364 mmol) 0 (4 ml) (3aS,4S,
 6R,6aR) -6-[2- -6-(2,2- -)- -9-]-2,2- - [3,4-d][
 1,3] -4- (0.15 g, 0.28 mmol) [WO 94/17090 4] 가
 . (0.045 ml, 0.364 mmol) 가 , 0 1.5
 . N- - (0.042 g, 0.56 mmol) 10 가 ,
 0 1 가 , 20
 , (2 x 10 ml) . (7 ml) , 1
 80 가 . (0.
 146 g)

LC/MS B R_t = "3.58" , m/z = "574" MH⁺

25: (2R,3R,4S,5S) -2-[2- -6-(2,2- -)- -9-]-5-(3- -[1,2,4]
 -5-)- -3,4-

(10 ml) (2.5 ml) 24(0.146 g, 0.255 mmol) 100 37
(2 x 10 ml)
(0.132 g)

LC/MS B R_t = "3.23" ,m/z = "534" MH⁺

26: {2 - 9 - [6S - (3 - [1,2,4] - 5 -) - 2,2 - - (3aR, 6aS) - [3,4 - d][1,3] - 4R -] - 9H - 6 - } - (1 -) -

(33 ml) 7(2.13 g, 5 mmol) 5 , N,N -
(1.9 ml, 11 mmol) (0.67 ml, 5.5 mmol) 가 , 1
가 . 5 , N - - (0.61 g, 6 mmol) (((

W.J. Franshawe), (V.J. Bauer), (S.R. Safir), (D.A. Blickens) (S.J. Riggi) [J. Med. Chem., 1969, 12, 381]) 가 , 가 16 .
(100 ml) , 가 24 120 가
(1:2) 가
(Varian Mega Bonded Elut cartridge) (SiO₂10 g)
(2.170 g)

LC/MS A R_t = "4.80" ,m/z = "490" MH⁺

27: (2R,3R,4S,5S) - 2 - [2 - 6 - (1 - -) - 9 -]
- 5 - (3 - - [1,2,4] - 5 -) - - 3,4 -

26(2.1 g, 4.5 mmol) 0 6 / (9:1, 25 ml)
(4) 16 (150 ml)
(3 x 50 ml)
(2 g)

LC/MS B R_t = "3.22" ,m/z = "450" MH⁺

28: {6R - (2 - 6 - - 9 -) - 2,2 - - (3aR,6aR) - [3,4 - d][1,3] - 4R - } -

(2 ml) 4R - 5R - - 2R - (2,6 - - 9 -) -
- 3 - (0.1 g, 0.224 mmol) ([Canad. J. Chem., 1981, 59(17), 2608]), 2 - (0.034 ml, 0.27 mmol) (0.047 ml, 0.27 mmol)
(, (Reactivial:)) 52 17.5 가 , (1 ml) (25 %, 0.077 ml, 0.336 mmol) 3.5
(0.2 ml) 가 . (2.5 ml)
, 2,2 - (0.35 ml) - (0.081 g)
66 [(3 ml) 2,2 - (0.35 ml)] 90 [- (81 mg)]
가 . 21 ,
(4 ml) 10 , (3 x 3 ml) , (MgSO₄) ,
(0.118 g)

LC/MS A R_t = "4.50" ,m/z = "C₂₁ H₂₄ ³⁵ ClN₅O₄ 446 MH⁺

29: {6R - [2 - 6 - (2 - -) - 9 -] - 2,2 - - (3aR,6aR) - [3,4 - d][1,3] - 4R - } -

2 -	(0.034 g, 0.27 mmol)	28	29
	(0.116 g)		
LC/MS	A $R_t = "4.93"$, $m/z = "C_{21} H_{30}^{35} ClN_5 O_4"$	452 MH ⁺	
	30: {6R - [2 - 6 - (3,3 -) - 9 -] - 2,2 - (3aR,6aR) - [3,4 - d][1,3] - 4R - }		
3,3 -	(0.036 g, 0.27 mmol)	28	30
	(0.111 g) 88%		
LC/MS	A $R_t = "4.93"$, $m/z = "C_{21} H_{30}^{35} ClN_5 O_4"$	452 MH ⁺	
	31: {6R - (6 -) - 2 - [2 - (1 - 1H - 4 -) - 9 -] - 2,2 - (3aR,6aR) - [3,4 - d][1,3] - 4R - }		
- 1H - 4 -)	(0.3 ml) DMSO (0.3 ml)	28 (0.118 g, 0.265 mmol)	2 - (1 -
가	(0.168 g, 1.344 ml,	(, ()) 104 20	(4 x 5 ml)
	(, ())	(0.5 M, 5 ml)	, ,
	, 50% EtOAc - , EtOAc		10% MeOH - EtOAc
가	(Si 5 g, 20 ml)		
	(0.107 g)		
TLC (10% MeOH - EtOAc, 가)	rf = "0.13		
	32: {6R - {6 - (2 -) - 2 - [2 - (1 - 1H - 4 -) - 9 -] - 2,2 - (3aR,6aR) - [3,4 - d][1,3] - 4R - }		
	29(0.116 g, 0.257 mmol)	31	32
	(0.09 g)		
TLC (10% MeOH - EtOAc, 가)	rf = "0.13		
	33: {6R - {6 - (3,3 -) - 2 - [2 - (1 - 1H - 4 -) - 9 -] - 2,2 - (3aR,6aR) - [3,4 - d][1,3] - 4R - }		
	30(0.111 g, 0.261 mmol)	31	33
	(0.097 g)		
TLC (10% MeOH - EtOAc, 가)	rf = "0.13		
	34: (3aS,4S,6R,6aR) - 6 - {6 - 2 - [2 - (1 - 1H - 4 -) - 9 -] - 2,2 - [3,4 - d][1,3] - 4 - }		

(1 ml) (0.1 g) (0.158 g, 1 mmol) (1.6 ml)
 31(0.107 g, 0.2 mmol) 0 5 가 . 4
 . 가 . (Harbourlite)
 2M pH 3 4
 , EtOAc (3 x 5 ml) . , (3 ml)
 2 x 1 ml) (0.084 g) .

LC/MS C R_t = "2.43" ,m/z = "549" MH⁺

35: (3aS,4S,6R,6aR) - 6 - { 6 - (2 - -) - 2 - [2 - (1 -
 - 1H - - 4 -) -] - - 9 - } - 2,2 - - [3,4 - d] [1,3] - 4 -

32(0.09 g, 0.17 mmol) 34 35
 (0.081 g) .

LC/MS C R_t = "2.61" ,m/z = "555" MH⁺

36: (3aS,4S,6R,6aR) - 6 - { 6 - (3,3 - -) - 2 - [2 - (1 -
 - 1H - - 4 -) -] - - 9 - } - 2,2 - - [3,4 - d] [1,3] - 4 -

(0.09 g, 1.52 mmol) (0.5 ml) (0.158 g, 0.95
 mmol) 가 , 1,4 - (1.6 ml) (0.5 ml)
 33(0.097 ml, 0.19 mmol) 가 , 0 0 3
 , (0.15 g) .
 , (10 ml) (2 x 20 ml)
 (0.064 g) .

LC/MS C R_t = "2.44" ,m/z = "529" MH⁺

37: 2 - (- 2 -) -

2 - (10.00 g, 63.3 mmol) 20 1,2 - (76.00 g, 126.6 mm
 ol) 가 . 20 4 , 24
 , , (30:8:1)
 (1.23 g) .

TLC SiO₂ (: : 30:8:1) R_f = "0.14

m/z 138 (C₇H₁₁N₃ MH⁺)

38: N - -

(400 ml) (20 ml, 280 mmol), (78 g, 560 mmol)
 (19.000 g, 280 mmol) 15 , 1 가
 , 7 , (100 ml)
 , (3 x 100 ml) (1
 7 g) .

TLC SiO₂ (5% / /1%) Rf = "0.21

39: 3- -5- (6R- -2,2- - (3aR,6aR) -

[3,4-d][1,3] -4S-) - [1,2,4]

DMF (200 ml) (3aS,4S,6R,6aR) - -2,2- - [3,4-d][1,3] -4-
 (14.800 g, 68 mmol, WO98/28319 1), 1-
 (9.200 g, 68 mmol) 1- (3-) -3- (13.000 g,
 68 mmol) , DMF (10 ml) 38(6.000 g, 68 mmol) 가
 , 70 가 , (100 ml)
 , 10% (2 x 100 ml), (1 x 100 ml) , (MgSO₄) ,
 (17.00 g) . (100 ml)

LC/MS C R_t = "1.77" ,m/z = "271" MH⁺

40: 4S- -2R- (3- - [1,2,4] -5-) -5S- - -3
 R-

(200 ml) 39(17 g, 62 mmol) (3 ml) 가 .
 , 가 50%가 , (50 ml) 가 ,
 25%가 (100 ml) 가 가 ,
 (150 ml) , (50 ml,) DMAP (0.38 g, 3 mmol)
 , 1
 0% (2 x 100 ml), (100 ml) , (MgSO₄) ,
 (3 x 90 g, SiO₂) . 30%
 (17.500 g) .

TLC SiO₂ (30% /) Rf = "0.52

41: 4S- -2R- (2,6- - -9-) -5S- (3-
 - [1,2,4] -5-) - -3R-

1,1,1,3,3,3, (5 ml) 2,6- (0.829 g, 4.3 mmol) 가
 , (3 x 5 ml)
 (2 ml) 40(0.500 g, 1.6 mmol) DBU (0.65 ml, 4.3 mmol) 가 ,
 , TMSOTf (0.9 ml, 4.8 mmol) 가 가 ,
 가 (5 ml) ,
 (3 x 10 ml) (20 ml) , (MgSO₄) ,
 60% , (8 g, SiO₂)
 (0.599 g) .

LC/MS C R_t = "3.32" ,m/z = "472" MH⁺

42: 4S- -2R- [6- -2- (1S- -2-
 -) - -9-] -5S- (3- - [1,2,4] -5-) - -3R-

DMF 41 (0.600 g, 1.27 mmol) - 10 - 15 (0.088 g,
 1.35 mmol) 가 , - 10 2 , DMF (1 ml) 3 - (S) - (-)2 -
 - 3 - (0.388 g, 2.8 mmol) 가 , 가 , (15
 ml) 가 , (3 x 15 ml) . (MgSO4) ,
 . 30% , (8 g, SiO2)
 (0.450 g)

LC/MS C R_t = "3.25" , m/z = "593" MH⁺
 가 43: 4S - - 2R - [6 - - 2 - (1S - - 2 -
 -) - - 9 -] - 5S - (3 - - [1,2,4] - 5 -) - - 3R -
 (5 ml) 42(0.440 g, 0.74 mmol) (0.220 g, 0.84 mmol)
 (0.410 g) . HPLC

LC/MS C R_t = "2.77" , m/z = "567" MH⁺
 < >
 1: (2R,3R,4S,5S) - 2 - {6 - (2,2 - -) - 2 - [2 - (1 - - 1H - - 4 -) -
] - - 9 - } - 5 - (3 - - [1,2,4] - 5 -) - - - 3,4 - (

1,4 - (2 ml) 2(0.050 g, 0.08 mmol) EEDQ (0.024 g, 0.096 mmol) N - -
 (0.012 g, 0.16 mmol) 6 103 가 .
 가 . 0 6 , (0.9 ml) (0.1 ml)
 HPLC (30 70%) , (3X)
 (0.006 g)

LC/MS A R_t = "3.98" , m/z = "623" MH⁺
 2: (2R,3R,4S,5S) - 2 - {6 - (2,2 - -) - 2 - [2 - (1 - - 1H - - 4 -) -
] - - 9 - } - 5 - (3 - - [1,2,4] - 5 -) - - - 3,4 - (

N - - (0.014 g, 0.16 mmol) 1 2
 . 1,4 - (2 ml) 2(0.050 g, 0.08 mmol) EEDQ (0.024 g, 0.096 mmol) N -
 - (0.014 g, 0.16 mmol) . 6 103
 가 . 가 . (0.9 ml) (0.1
 ml) 가 . 0 6 , ,
 (3X) . HPLC (30 70%) , (0.0
 12 g)

LC/MS A R_t = "4.02" , m/z = "637" MH⁺
 3: (2R,3R,4S,5S) - 2 - [6 - (2,2 - -) - 2 - (- 3R -) - - 9 -] - 5 - (3
 - - [1,2,4] - 5 -) - - - 3,4 -

(, ()) 4(0.034 g, 0.062 mmol), (3R) - (+ - 3 -) (0.
 030 ml, 0.311 mmol) DMSO (0.03 ml) 80 28 가 .
 HPLC (0.017 g) .

LC/MS A R_t = "3.65" ,m/z = "598" MH⁺

4: (2R,3R,4S,5S) - 2 - [2 - (- 4 - -) - 6 - (2,2 - -) - - 9
 -] - 5 - (3 - - [1,2,4] - 5 -) - - - 3,4 -
 - 1,4 - (0.035 g, 0.311 mmol) 3
 4 (0.013 g) .

LC/MS B R_t = "2.58" ,m/z = "626" MH⁺

5: (2R,3R,4S,5S) - 2 - [6 - (2,2 - -) - 2 - (1S -
 - 2 - -) - - 9 -] - 5 - (3 - - [1,2,4] - 5 -) - - - 3,4 -

(S) - 2 - - 3 - - 1 - (0.032 g, 0.311 mmol) 3
 5 , 80 95 3 가 . (0.
 005 g) .

LC/MS B R_t = "3.16" ,m/z = "615" MH⁺

6: (2R,3R,4S,5S) - 2 - [6 - (1 - -) - 2 - (2 - - 4 - -) - - 9 -] -
 5 - (3 - - [1,2,4] - 5 -) - - - 3,4 -

11(0.069 g, 0.163 mmol) 4 - (2 -) (0.107 ml, 0.815 mmol) DMSO (0.03 ml)
 ((()) 80 26 가 , 20 4 -
 (2 -) (0.053 ml, 0.407 mmol) 가 . HPLC
 (0.059 g) .

LC/MS B R_t = "2.19" ,m/z = "517" MH⁺

7: (2R,3R,4S,5S) - 2 - { 6 - - 2 - [2 - (1 - - 1H - - 4 -) -] - - 9 - } - 5
 - (3 - - [1,2,4] - 5 -) - - - 3,4 - ()

DMSO (0.05 ml) 17(0.048 g) 2 - (1 - - 1H - - 4 -) (0.06 g)
 ((()) 90 20 가 . HPLC (10 60%
 , 22) 2 , ,
 (0.007 g) .

LC/MS A R_t = "1.8" ,m/z = "443" MH⁺

8: (2R,3R,4S,5S) - 2 - [6 - - 2 - (2 - - 2 - -) - - 9 -] - 5 - (3 - - [1,2,4
] - 5 -) - - - 3,4 -

18(0.041 g), 2 - (2 -) (0.06 ml) DMSO (0.05 ml) ((()
) 90 16 가 . HPLC
 , (0.011 g) .

LC/MS B R_t = "1.92" ,m/z = "454" MH⁺

9: (2R,3R,4S,5S) - 2 - [6 - - 2 - (1S - - 2 - -) - - 9 -] - 5 - (3 -
- [1,2,4] - 5 -) - - - 3,4 -

18(0.041 g), (S) - (-) - 2 - - 3 - - 1 - (0.06 g) DMSO (0.05 ml) ()
() 90 32 가 , 110 16 가 . (0.003 g)
HPLC 2 ,

LC/MS B R_t = "2.36" ,m/z = "483" MH⁺

9(): 2R - [6 - - 2 - (1S - - 2 - -) -
- 9 -] - 5S - (3 - - [1,2,4] - 5 -) - - - 3R,4S -

(3 ml) 43(0.160 g, 0.28 mmol) (0.009 g, 0.14 mmol) 30
HPLC (0.0
50 g)

LC/MS C R_t = "2.35" ,m/z = "483" MH⁺

10: (2R,3R,4S,5S) - 2 - {6 - - 2 - [2 - (1 - - 1H - - 4 -) -) - - 9 - } -
5 - (3 - - [1,2,4] - 5 -) - - - 3,4 -

18(0.041 g), 2 - (1 - - 1H - - 4 -) - (0.06 g) DMSO (0.05 ml) ()
() 90 32 가 , 110 16 가 . (0.014 g)
HPLC ,

LC/MS B R_t = "1.88" ,m/z = "457" MH⁺

11: (2R,3R,4S,5S) - 2 - (6 - - 2 - - 9 -) - 5 - (3 - - [1,2,4] -
5 -) - - - 3,4 -

DMSO (0.05 ml) 17(0.048 g), (0.06 ml) () ()
90 20 가 HPLC , ,
(0.006 g)

LC/MS A R_t = "2.2" ,m/z = "403" MH⁺

12: (2R,3R,4S,5S) - 2 - [6 - - 2 - (1S - - 2 - -) - - 9 -] - 5 - (3 -
- [1,2,4] - 5 -) - - - 3,4 -

DMSO (0.05 ml) 17(0.048 g), (S) - (-) - 2 - - 3 - - 1 - (0.06 g) ()
() 90 20 가 HPLC 2 ,
(0.002 g)

LC/MS A R_t = "2.24" ,m/z = "469" MH⁺

13: (2S,3S,4R,5R) - 2 - (3 - [1,2,4] - 5 -) - 5 - {6 - (1 -

-) - 2 - [2 - (1 - 1H - 4 -) -] - 9 - } - - 3,4 -

9(0.070 g, 0.161 mmol) 2 - (1 - 1H - 4 -) (0.101 g, 0.807 mmol) DMSO (0.03 ml) , 85 100 8 가 , 5 2 - (1 - 1H - 4 -) (0.101 g, 0.807 mmol) 가 . HPLC , (0.010 g) .

LC/MS A $R_t = "3.36"$, $m/z = "526"$ MH⁺

14: (2R,3R,4S,5S) - 2 - {6 - (1 - -) - 2 - [2 - (1 - 1H - 4 -) -] - 9 - } - 5 - (3 - [1,2,4] - 5 -) - - 3,4 -

11(0.069 g, 0.163 mmol) 2 - (1 - 1H - 4 -) (0.102 g, 0.815 mmol) DMSO (0.03 ml) , 85 100 7 가 , 5 2 - (1 - 1H - 4 -) (0.102 g, 0.815 mmol) 가 . HPLC , (0.013 g) .

LC/MS A $R_t = "3.32"$, $m/z = "512"$ MH⁺

15: (2R,3R,4S,5S) - 2 - (6 - 2 - - 9 -) - 5 - (3 - [1,2,4] - 5 -) - - 3,4 -

21(0.210 g, 0.44 mmol) (9:1, 2 ml) , 20 3 HPLC (10 90%) , (0.088 g) .

$m/z 439$ (C₂₀ H₂₃ N₈ O₄ MH⁺)

: C, 46.70; H, 4.05; N, 19.51; C₂₀ H₂₂ N₈ O₄ · C₂ HF₃ O₂ · 0.5H₂O C, 46.54; H, 4.24; N, 19.56

16: (2R,3R,4S,5S) - 2 - [2 - (4 - -) - 6 - (1 - -) - 9 -] - 5 - (3 - [1,2,4] - 5 -) - - 3,4 -

11(0.069 g, 0.163 mmol) - 1,4 - (0.093 g, 0.815 mmol) DMSO (0.03 ml) , (, ()) 80 90 66 가 , 20 - 1,4 - (0.093 g, 0.815 mmol) 가 . HPLC , (0.063 g) .

LC/MS B $R_t = "2.12"$, $m/z = "502"$ MH⁺

17: (2R,3R,4S,5S) - 2 - [6 - (1 - -) - 2 - (1S - 2 - -) - 9 -] - 5 - (3 - [1,2,4] - 5 -) - - 3,4 -

11(0.069 g, 0.163 mmol) 3 - (S) - (-) 2 - - 3 - (0.123 g, 0.815 mmol) DMSO (0.03 ml) , (, ()) 80 95 5.5 가 . HPLC , (0.014 g) .

LC/MS B R_t = "2.80" ,m/z = "539" MH⁺

18: (2R,3R,4S,5S) - 2 - [6 - (1 - -) - 2 - (2 - - 1 - -) - - 9 -]
- 5 - (3 - - [1,2,4] - 5 -) - - - 3,4 -

11(0.069 g, 0.163 mmol) 2 - (0.116 ml, 0.815 mmol) DMSO (0.03 ml)
(, ()) 80 40 가 , 20 2 -
(0.058 ml, 0.407 mmol) 가 . HPLC ,
(0.031 g) .

LC/MS B R_t = "2.25" ,m/z = "516" MH⁺

19: (2S,3S,4R,5R) - 2 - (3 - - [1,2,4] - 5 -) - 5 - [6 - (1 -
-) - 2 - (2 - - 4 - -) - - 9 -] - - - 3,4 -

9(0.070 g, 0.161 mmol) 4 - (2 -) (0.106 ml, 0.807 mmol) DMSO (0.03 ml)
(, ()) 80 26 가 , 6 4
(2 -) (0.053 ml, 0.403 mmol) 가 . HPLC ,
(0.049 g) .

LC/MS B R_t = "2.27" ,m/z = "532" MH⁺

20: (2S,3S,4R,5R) - 2 - (3 - - [1,2,4] - 5 -) - 5 - [6 - (1 -
-) - 2 - (2 - - 1 - -) - - 9 -] - - - 3,4 -

9(0.070 g, 0.161 mmol) 2 - (0.115 ml, 0.807 mmol) DMSO (0.03 ml)
(, ()) 80 40 가 , 20 2 -
(0.057 ml, 0.403 mmol) 가 . HPLC ,
(0.035 g) .

LC/MS B R_t = "2.33" ,m/z = "530" MH⁺

21: (2S,3S,4R,5R) - 2 - (3 - - [1,2,4] - 5 -) - 5 - [6 - (1 -
-) - 2 - (2 - - 2 - -) - - 9 -] - - - 3,4 -

9(0.070 g, 0.161 mmol) 2 - (2 -) (0.096 ml, 0.807 mmol) DMSO (0.03 ml)
(, ()) 80 46 가 , 20 2 -
(2 -) (0.096 ml, 0.807 mmol) 가 . HPLC ,
(0.035 g) .

LC/MS B R_t = "2.38" ,m/z = "524" MH⁺

22: (2R,3R,4S,5S) - 2 - [2 - - 6 - (1 - -) - - 9 -] - 5 - (3 - - [1,2,4] - 5 -) - - - 3,4 -

11(0.069 g, 0.163 mmol) (0.08 ml, 0.815 mmol) DMSO (0.03 ml)
(, ()) 80 20 가 . HPLC ,
(0.007 g) .

LC/MS B R_t = "2.31" ,m/z = "488" MH⁺

28: (2R,3R,4S,5S) - 2 - [6 - (1 - -) - 2 - (1S - - 2 - -) -
- 9 -] - 5 - (3 - - [1,2,4] - 5 -) - - - 3,4 -

11(0.069 g, 0.163 mmol) L - 2 - - 3 - (0.084 g, 0.815 mmol) DMSO (0.03 ml)
, (, ()) 80 95 5.5 가 .
HPLC , (0.030 g) .

LC/MS B R_t = "2.59" ,m/z = "491" MH⁺

29: (2R,3R,4S,5S) - 2 - [2 - (- 4 - -) - 6 - (1 - -) - - 9
-] - 5 - (3 - - [1,2,4] - 5 -) - - - 3,4 -

9(0.070 g, 0.161 mmol) - 1,4 - (0.092 g, 0.807 mmol) DMSO (0.03 m
l) , (, ()) 80 90 66 가 , 20
- 1,4 - (0.092 g, 0.807 mmol) 가 .
HPLC , (0.082 g) .

LC/MS B R_t = "2.21" ,m/z = "516" MH⁺

30: (2R,3R,4S,5S) - 2 - [6 - - 2 - (2 - - 2 - -) - - 9 -] - 5 - (3 - - [1,2,
4] - 5 -) - - - 3,4 -

DMSO (0.05 ml) 17(0.048 g) 2 - (2 -) (0.06 ml) (,
()) 90 20 가 . 2 - (2 -) (0.05 ml) 가 , 11
0 16 가 . HPLC , ()
0.0015 g) .

LC/MS B R_t = "1.88" ,m/z = "440" MH⁺

31: (2R,3R,4S,5S) - 2 - [6 - (2,2 - -) - 2 - (2 - - 4 - -) - - 9 -
] - 5 - (3 - - [1,2,4] - 5 -) - - - 3,4 -

(, ()) 4(0.034 g, 0.062 mmol), 4 - (2 -) (0.0
41 ml, 0.31 mmol) DMSO (0.03 ml) 80 28 가 . HPLC
, (0.015 g) .

LC/MS A R_t = "3.67" ,m/z = "642" MH⁺

32: (2R,3R,4S,5S) - 2 - [6 - (2,2 - -) - 2 - (2 - - 1 - -) - - 9 -
] - 5 - (3 - - [1,2,4] - 5 -) - - - 3,4 -

(, ()) 4(0.034 g, 0.062 mmol), 2 - (0.044 m
l, 0.311 mmol) DMSO (0.03 ml) 80 28 가 . HPLC
, (0.010 g) .

LC/MS A R_t = "3.72" ,m/z = "640" MH⁺

33: (2R,3R,4S,5S) - 2 - {6 - (2,2 - -) - 2 - [2 - (1 - - 1H - - 4 -) -
] - - 9 - } - 5 - (3 - - [1,2,4] - 5 -) - - - 3,4 -

(, ()) (0.04 ml) DMSO (0.04 ml) 2
 3(0.075 g, 0.135 mmol) 2 - (1 - - 1H - - 4 -) (0.085 ml, 0.677 mmol) 8
 5 40 가 . 20 2 - (1 - - 1H - - 4 -) (0.085 ml,
 0.677 mmol) 가 . HPLC , ()
 0.037 g) .

LC/MS B R_t = "2.71" , m/z = "651" MH⁺

34: (2R,3R,4S,5S) - 2 - {6 - (2,2 - -) - 2 - [2 - (1H -
 - 4 -) -] - - 9 - } - 5 - (3 - - [1,2,4] - 5 -) - - - 3,4 -

(, ()) (0.04 ml) DMSO (0.04 ml) 2
 5(0.132 g, 0.248 mmol) (0.138 g, 1.24 mmol) 85 90 40 가
 . HPLC , (0.032 g)

LC/MS B R_t = "2.59" , m/z = "609" MH⁺

35: (2S,3S,4R,5R) - 2 - (3 - - [1,2,4] - 5 -) - 5 - [6 - (1 - -) - 2
 - (2 - - 1 -) - - 9 -] - - - 3,4 -

(, ()) (0.3 ml) 27(70 mg, 0.15 mmol) 2 -
 (0.117 ml, 0.83 mmol) 4 90 가 .
 HPLC , (0.015 g) .

LC/MS C R_t = "2.32" , m/z = "542" MH⁺

36: (2S,3S,4R,5R) - 2 - (3 - - [1,2,4] - 5 -) - 5 - [6 - (1 - -) - 2
 - (2 - - 4 -) - - 9 -] - - - 3,4 -

90 4 4 - (2 -) (0.108 ml, 0.825 mmol) 35
 36 . (0.009 g) .

LC/MS C R_t = "2.32" , m/z = "544" MH⁺

37: (2S,3S,4R,5R) - 2 - (3 - - [1,2,4] - 5 -) - 5 - [6 - (1 - -) - 2
 - (2 - (2 -) -) - - 9 -] - - - 3,4 -

90 4 2 - (2 -) (0.104 g, 0.825 mmol) 35
 37 . (0.012 g) .

LC/MS C R_t = "2.18" , m/z = "535" MH⁺

38: (2S,3S,4R,5R) - 2 - (3 - - [1,2,4] - 5 -) - 5 - [6 - (1 - -) - 2
 - (2 - (1 - - 1H - - 4 -) -) - - 9 -] - - - 3,4 -

90 4 2 - (1 - - 1H - - 4 -) - (0.14 g, 0.825 mmol,
) 35 38
 (0.015 g) .

LC/MS C R_t = "2.32" ,m/z = "542" MH⁺

39: (2R,3R,4S,5S) - 2 - [6 - (2,2 - -) - 2 - (2 - - 1 - -) - - 9 -
] - 5 - (3 - - [1,2,4] - 5 -) - - - 3,4 -

(, ()) (0.2 ml) 3(70 mg, 0.15 mmol) 1 -
 (2 -) (0.114 g, 1 mmol) 90 4 가
 HPLC , (0.008 g) .

LC/MS B R_t = "2.67" ,m/z = "626" MH⁺

40: (2R,3R,4S,5S) - 2 - {6 - (2,2 - -) - 2 - [2 - (- 2 -) -] -
 - 9 - } - 5 - (3 - - [1,2,4] - 5 -) - - - 3,4 -

90 4 37(0.137 g, 1 mmol) 39 40
 . (0.003 g) .

LC/MS A R_t = "2.74" ,m/z = "649" MH⁺

41: (2R,3R,4S,5S) - 2 - {2 - ([2.2.1] - 2 -) - 6 - (2,2 - -) - - 9
 - } - 5 - (3 - - [1,2,4] - 5 -) - - - 3,4 -

90 4 (±) - 2 - (0.110 g, 1 mmol) 39
 41 . (0.008 g) .

LC/MS B R_t = "3.77" ,m/z = "623" MH⁺

42: (2R,3R,4S,5S) - 2 - {2 - (2 - [3,4 - -] -) - 6 - (2,2 - -) -
 9 - } - 5 - (3 - - [1,2,4] - 5 -) - - - 3,4 -

90 4 2 - (3,4 -) - (0.181, 1 mmol) 39
 42 . (0.002 g) .

LC/MS B R_t = "3.42" ,m/z = "693" MH⁺

43: (2R,3R,4S,5S) - 2 - [6 - (2,2 - -) - 2 - (2 - -) - - 9 -] - 5 -
 (3 - - [1,2,4] - 5 -) - - - 3,4 -

90 4 2 - - (0.061 g, 1 mmol) 39
 43 . (0.013 g) .

LC/MS B R_t = "3.02" ,m/z = "573" MH⁺

44: (2R,3R,4S,5S) - 2 - [6 - (2,2 - -) - 2 - (4 - -) - - 9 -] - 5 -
 (3 - - [1,2,4] - 5 -) - - - 3,4 -

(0.11 g, 1 mmol) () DMSO (0.2 ml) 3(50 mg, 0.09 mmol) 4 -
 HPLC 90 20 가 , 110 20 가 .
 (0.005 g)

LC/MS C R_t = "3.60" ,m/z = "623" MH⁺

45: (2R,3R,4S,5S) - 2 - [2 - (1 - - 3S -) - 6 - (2,2 - -) - - 9 -
] - 5 - (3 - - [1,2,4] - 5 -) - - 3,4 -

90 20 1 - - 3S - - (0.18 g, 1 mmol) 35
 45 (0.003 g)

LC/MS C R_t = "2.75" ,m/z = "688" MH⁺

46: (2R,3R,4S,5S) - 2 - {6 - - 2 - [2 - (1 - - 1H - - 4 -) -] - - 9 -
 - } - 5 - (3 - - [1,2,4] - 5 -) - - 3,4 -

34(0.083 mg, 0.15 mmol) DCM/THF (9:1, 3 ml) . N,N -
 (0.057 ml, 3.32 mmol) (0.021 ml, 0.16 mmol) 0
 가 2 가 , 0 , N - -
 (0.5 ml 0.015 g, 0.18 mmol) 가 .
 가 , 16 (10 ml)
 120 8 가 / (50:1 1:1)
 가 (5 g Si, 20 ml) (0.01 g)
 4 0 / (4 ml, 9:1)
 (2 x 50 ml) , HPLC
 (0.004 g)

LC/MS C R_t = "2.39" ,m/z = "561" MH⁺

47: (2R,3R,4S,5S) - 2 - {6 - (2 -) - 2 - [2 - (1 - - 1H - - 4 -) -
] - - 9 - } - 5 - (3 - - [1,2,4] - 5 -) - - 3,4 -

DCM/THF (9:1, 2 ml) N - - (0.014 g, 0.175 mmol) 35(0.081 g, 0.146
 mmol), (0.02 ml, 0.16 mmol), N,N - (0.056 ml, 0.32 mmol)
 46 47 HPLC
 (0.003 g)

LC/MS C R_t = "2.54" ,m/z = "567" MH⁺

48: (2R,3R,4S,5S) - 2 - {6 - (3,3 - -) - 2 - [2 - (1 - - 1H - - 4 -) -
] - - 9 - } - 5 - (3 - - [1,2,4] - 5 -) - - 3,4 -

DCM/THF (9:1, 2 ml) N - - (0.087 g, 0.11 mmol) 36(0.05 g, 0.09 mm
 ol), (0.012 ml, 0.1 mmol), N,N - (0.035 ml, 0.2 mmol)
 46 48 HPLC
 (0.002 g)

LC/MS C R_t = "2.42" ,m/z = "541" MH⁺

< >

(1) () , 가

실시에 번호	A2a	A3	A1
1	1.19	>197	1306
2	0.64	>197	1823
3*	4.63	>304	6719

실시에 번호	A2a	A3	A1
4	5.37	>383	>=3996
5	6.12	>309	1391.2
6*	41.35	>642	>4833
7*	11.02	>117	1013.4
8*	14.05	>215	>=3865
9*	0.81	>231	1692.4
9**	0.086	>287	3006
10*	7.66	>269	3449.6
11*	6.66	>266	145.5
12*	4.54	>302	1863.5
13	0.61	>289	>=4370
14	0.66	>239	>4587
15	2.29	>130	>5511
16*	11.87	>362	>6244
17*	3.97	>362	>6244
18*	8.16	>314	>6244
19*	34.52	>694	>5860
20*	17.08	>694	>=1853
21*	9.39	>303	>5090
22	22.25	>193	78.28
23	12.72	>163	17.02
24	18.13	>284	>5264
25	19.35	>163	515.35
26*	5.18	>284	>5264
27*	10.5	>284	263.14
28*	5.49	>284	>5263
29*	8.92	>117	989.5

실시에 번호	A2a	A3	A1
30*	19.54	>215	1460.7
31	30.6	>262	6452
32	31.4	>258	7521
33*	8.35	>259	≥815.9
34*	8.31	231.1	3270.8
35	7.89	>194	912.1
36	20.13	>194	>9364
37	49.45	>87	>10402
38	2.02	>87	670.04
39	30.21	>130	4505.4
40	4.89	>130	>=3311.7
41	23.93	>130	2033.2
42	32.77	>130	>6064
43	6.85	>130	1367.6
44	94.39	>165	>6131
45	29.82	>165	>3738.84
46	0.90	>165	3560.13
47	6.93	>165	4993.28
48	4.40	>165	16.84

* 테이타는 시험후 제조물이 비활성 불순물을 함유한 것으로 확인되었기 때문에 최소값에 해당한다.

** 제시된 정제된 화합물에 대한 테이타이다

NECA

EC₅₀

< >

TMS

TFA

DMFN,N -

NECAN -

DMAP4 -

TEMPO2,2,6,6 - - 1 - ,

TMSOTf

DBU1,8 - [5,4,0] - 7 -

BSA

DCM

DAST

Ph

CDI

EEDQ2 - - 1 - - 1,2 -

NSAID

DMSO

Me

Et

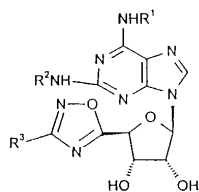
THF

(57)

1.

I

< I >



R¹ R²

(i) C₃₋₈ - ,

(ii) ,

(iii) ₂CHCH₂ - ,(iv) C₃₋₈ C₁₋₆ - ,(v) C₁₋₈ - ,(vi) C₁₋₆ - ,(vii) R⁴R⁵N - C₁₋₆ - ,(viii) C₁₋₆ - CH(CH₂OH) - ,

(ix) C₁₋₅ -CH(CH₂OH) - ,

(x) C₁₋₅ -C(CH₂OH)₂ - ,

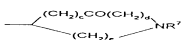
(xi) -(CH₂)_pR⁶ C₃₋₈ ,

(xii) H₂NC(=NH)NHC₁₋₆ - ,

(xiii)  , X 가

(xiv) -C₁₋₆ -OH,

(xv) -C₁₋₈ ,

(xvi)  ,

(xvii) ,

(xviii) -(CH₂)_fSO₂NH_g(C₁₋₄ -)_{2-g} -(CH₂)_fSO₂NH_g(C₁₋₄ -)_{2-g}

R³ , , -CH="CH₂, n - , -CH₂CH="CH₂, -CH="CHCH₃, , ,
 , -CH(OH)CH₃, -(CH₂)_q , -(CH₂)_nY(CH₂)_iH, -COO(CH₂)_lH, -CON(CH₂)_mH((CH₂)_nH), -CO
 (CH₂)_oH -C((CH₂)_uH)="NO(CH₂)_vH ,

Y O, S N(CH₂)_jH ,

a b 0 4 , a + b 3 5 ,

c, d e 0 3 , c + d + e 2 3 ,

f 2 3 , g 0 2 ,

p 0 1 ,

q 1 2 ,

h 1 2 i 0 1 , h + i 1 2 ,

j 0 1 , h + i + j 1 2 ,

l 1 2 ,

m n 0 2 , m + n 0 2 ,

o 0 2 ,
 u v 0 1 , u + v 0 1 ,
 R^4 R^5 , C_{1-6} , , C_{1-6} - , NR^4R^5 가 ,
 , , , , , N - C_{1-6} ,
 R^6 OH, NH_2 , $NHCOCH_3$,
 R^7 , C_{1-6} , - C_{1-6} - COC_{1-6} ,
 X NR^7 , O, S, SO SO_2 .

2.

1 , R^3 , , n - , - CH_2OH | .

3.

2 , R^3 , n - | .

4.

2 , R^3 | .

5.

1 4 , R^1 R^2 가 | .

6.

1 5 | , R^1 C_{1-8} - , C_{3-8} C_{1-6} - , C_{1-6} -

7.

1 5 , R^1 $_2CHCH_2$ - | .

8.

6 | , R^1 - $CH(CH_2CH_3)_2$, , - $(CH_2)_2C(CH_3)_3$

9.

1 5 | , R^1 Ph_2CHCH_2 - , - $CH(CH_2CH_3)_2$, -

10.

7, R¹ Ph₂CHCH₂ - | .

11.

1 10, R²가 -CH(CH₂OH)C₁₋₃, 4 -
CH₂CH₂ - | .

12.

1 10, R²가 C₁₋₆ N - -3 - , R⁴R⁵NC₁₋₆
, C₁₋₆ -OH, C₁₋₅ -CH(CH₂OH) -, C₃₋₈ (CH₂)₂ -
(CH₂)_pR⁶ C₃₋₈ | .

13.

12, R²가 2 - (1H - -4 -) , -1 - , -1 - , -2 -
, (±) - -2 - , 3,4 - , 2 - , 4 - , N - -
-3 - , -2 - , 1S - -2 - , , -1 - 2 -
| .

14.

11, R²가 -CH(CH₂OH)CH(CH₃)₂, -4 - - , 2 - (1 - -1H - -4 -
)CH₂CH₂ - -3 - | .

15.

1 10, R²가 2 - (1 - -1H - -4 -)CH₂CH₂ -, 1S -
-2 - , 1S - -2 - - | .

16.

1 15, R⁴ R⁵가 , C₁₋₆ , , C₁₋₆ -
, NR⁴R⁵가 , , N - C₁₋₆
| .

17.

16, R⁴ R⁵가 , NR⁴R⁵가 , ,
, N - | .

18.

1, (2R,3R,4S,5S) -2 - {6 - (2,2 - -) -2 - [2 - (1 - -1H - -4 -) -
] - -9 - } -5 - (3 - - [1,2,4] -5 -) - -3,4 -
| .

19.

1 , (2R,3R,4S,5S) - 2 - [6 - - 2 - (1S - - 2 - -) - - 9 -] - 5 -
 (3 - - [1,2,4] - 5 -) - - - 3,4 -
 |

20.

1 ,

(2R,3R,4S,5S) - 2 - {6 - (2,2 - -) - 2 - [2 - (1 - - 1H - - 4 -) -] - -
 9 - } - 5 - (3 - - [1,2,4] - 5 -) - - - 3,4 - ,

(2R,3R,4S,5S) - 2 - [6 - (2,2 - -) - 2 - (- 3R -) - - 9 -] - 5 - (3 - - [1,
 2,4] - 5 -) - - - 3,4 - ,

(2R,3R,4S,5S) - 2 - [2 - (- 4 - -) - 6 - (2,2 - -) - - 9 -] - 5 -
 (3 - - [1,2,4] - 5 -) - - - 3,4 - ,

(2R,3R,4S,5S) - 2 - [6 - (2,2 - -) - 2 - (1S - - 2 - -) - - 9 -]
 - 5 - (3 - - [1,2,4] - 5 -) - - - 3,4 - ,

(2R,3R,4S,5S) - 2 - [6 - (1 - -) - 2 - (2 - - 4 - -) - - 9 -] - 5 - (3 -
 - [1,2,4] - 5 -) - - - 3,4 - ,

(2R,3R,4S,5S) - 2 - {6 - - 2 - [2 - (1 - - 1H - - 4 -) -] - - 9 - } - 5 - (3 -
 - [1,2,4] - 5 -) - - - 3,4 - ,

(2R,3R,4S,5S) - 2 - [6 - - 2 - (2 - - 2 - -) - - 9 -] - 5 - (3 - - [1,2,4]
 - 5 -) - - - 3,4 - ,

(2R,3R,4S,5S) - 2 - {6 - - 2 - [2 - (1 - - 1H - - 4 -) -] - - 9 - } - 5 - (3 -
 - [1,2,4] - 5 -) - - - 3,4 - ,

(2R,3R,4S,5S) - 2 - (6 - - 2 - - 9 -) - 5 - (3 - - [1,2,4] - 5 -) -
 - - 3,4 - ,

(2R,3R,4S,5S) - 2 - [6 - - 2 - (1S - - 2 - -) - - 9 -] - 5 - (3 - - [1,2,4]
] - 5 -) - - - 3,4 - ,

(2S,3S,4R,5R) - 2 - (3 - - [1,2,4] - 5 -) - 5 - {6 - (1 - -) - 2 - [2 - (1 - - 1H
 - - 4 -) -] - - 9 - } - - - 3,4 - ,

(2R,3R,4S,5S) - 2 - {6 - (1 - -) - 2 - [2 - (1 - - 1H - - 4 -) -] - - 9
 - } - 5 - (3 - - [1,2,4] - 5 -) - - - 3,4 - ,

(2R,3R,4S,5S) - 2 - (6 - - 2 - - 9 -) - 5 - (3 - - [1,2,4] - 5 -) -
 - - 3,4 - ,

(2R,3R,4S,5S) - 2 - [2 - (- 4 - -) - 6 - (1 - -) - - 9 -] - 5 - (
 3 - - [1,2,4] - 5 -) - - - 3,4 - ,

(2R,3R,4S,5S) - 2 - [6 - (1 - -) - 2 - (1S - - 2 - -) - - 9 -] - 5 -
 (3 - - [1,2,4] - 5 -) - - - 3,4 - ,

(2R,3R,4S,5S) - 2 - [6 - (1 - -) - 2 - (2 - - 1 - -) - - 9 -] - 5 - (3 -
 - [1,2,4] - 5 -) - - - 3,4 - ,

(2S,3S,4R,5R) - 2 - (3 - - [1,2,4] - 5 -) - 5 - [6 - (1 - -) - 2 - (2 - - 4 -
 -) - - 9 -] - - - 3,4 - ,

(2S,3S,4R,5R) - 2 - (3 - - [1,2,4] - 5 -) - 5 - [6 - (1 - -) - 2 - (2 - - 1 -
 -) - - 9 -] - - - 3,4 - ,

(2S,3S,4R,5R) - 2 - (3 - - [1,2,4] - 5 -) - 5 - [6 - (1 - -) - 2 - (2 - - 2 -
 -) - - 9 -] - - - 3,4 - ,

(2R,3R,4S,5S) - 2 - [2 - - 6 - (1 - -) - - 9 -] - 5 - (3 - - [1,2,4]
 - 5 -) - - - 3,4 - ,

(2R,3R,4S,5S) - 2 - [2 - - 6 - (1 - -) - - 9 -] - 5 - (3 - - [1,2,4]
 - 5 -) - - - 3,4 - ,

(2R,3R,4S,5S) - 2 - [6 - (1 - -) - 2 - (2S - - (S) -) - - 9 -] -
 5 - (3 - - [1,2,4] - 5 -) - - - 3,4 - ,

(2S,3S,4R,5R) - 2 - (3 - - [1,2,4] - 5 -) - 5 - [6 - (1 - -) - 2 - (2S - -
 - (S) -) - - 9 -] - - - 3,4 - ,

(2R,3R,4S,5S) - 2 - [6 - (1 - -) - 2 - (- 3R -) - - 9 -] - 5 - (3 - - [1,2,
 4] - 5 -) - - - 3,4 - ,

(2S,3S,4R,5R) - 2 - (3 - - [1,2,4] - 5 -) - 5 - [6 - (1 - -) - 2 - (- 3R -
) - - 9 -] - - - 3,4 - ,

(2R,3R,4S,5S) - 2 - [6 - (1 - -) - 2 - (1S - - 2 - -) - - 9 -] -
 5 - (3 - - [1,2,4] - 5 -) - - - 3,4 - ,

(2R,3R,4S,5S) - 2 - [2 - (- 4 - -) - 6 - (1 - -) - - 9 -] - 5 - (
 3 - - [1,2,4] - 5 -) - - - 3,4 - ,

(2R,3R,4S,5S) - 2 - [6 - - 2 - (2 - - 2 - -) - - 9 -] - 5 - (3 - - [1,2,4]
 - 5 -) - - - 3,4 - ,

(2R,3R,4S,5S) - 2 - [6 - (2,2 - -) - 2 - (2 - - 4 - -) - - 9 -] - 5 - (3 -
 - [1,2,4] - 5 -) - - - 3,4 - ,

(2R,3R,4S,5S) - 2 - [6 - (2,2 - -) - 2 - (2 - - 1 - -) - - 9 -] - 5 - (3 -
 - [1,2,4] - 5 -) - - - 3,4 - ,

(2R,3R,4S,5S) - 2 - {6 - (2,2 - -) - 2 - [2 - (1 - - 1H - - 4 -) -] - -
 9 - } - 5 - (3 - - [1,2,4] - 5 -) - - - 3,4 - ,

22.

1 20 I 가 .

23.

1 20 I 가 , ,
(COPD) .

24.

1 20 , , I COPD 가 .

25.

(i) II $R^2 NH_2$ (, R^2 1 , 5 , 11 15
18 20) ,

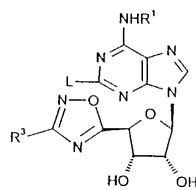
(ii) VI OH - N = "C(R^3)NH₂ (, R^3
1 4 18 20) ,

(iii) IX X ,

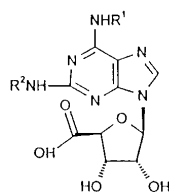
(iv) I ,

20 I I , 1

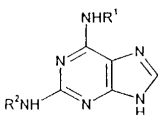
< II >



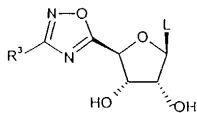
< VI >



< IX >



< X >



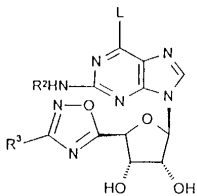
(R^1 1, 5, 10, 18, 20, R^2 1, 4, R^3 1, 4, L, 18, 20).

26.

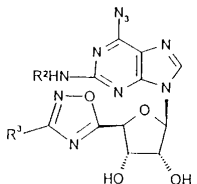
(i) IIa (R^1 NH₂ (R^1 1, 5, 10, 18, 20))

(ii) IIb (R^1 I, I)

< IIa >



< IIb >

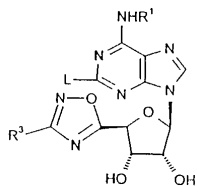


(R^2 1, 5, 11, 15, 18, 20, L, R^3 1, 4, 18, 20, R).

27.

II

< II >

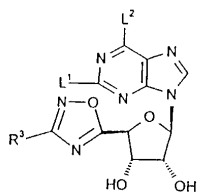


4, R¹ 1, 5 10 18 20, L, R³ 1

28.

V

< V >

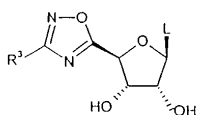


, R³ 1 4 18 20, L¹ L²

29.

X

< X >



, R³ 1 4 18 20, L