AUSTRALIA

PATENTS ACT 1990

PATENT REQUEST: STANDARD PATENT

653457

We, ORTHO PHARMACEUTICAL CORPORATION, a corporation organised under the laws of the State of Delaware, United States of America, being the person identified below as the Applicant, request the grant of a patent to the person identified below as the Nominated Person, for an invention described in the accompanying standard complete specification.

Full application details follow.

Applicant: ORTHO PHARMACEUTICAL CORPORATION

Address: U.S. Route 202, Raritan, New Jersey 08869-0602,
United States of America

Nominated Person: As above

Address: As above

Invention Title: "A PROCESS FOR PREPARING 2-CHLORO-2'-DEOXYADENOSINE"

Name of actual inventor: Robert H.K. Chen

BASIC CONVENTION APPLICATIONS DETAILS:

Application Numbers: 07/810,992 and 07/869,689
Country: United States of America
Country Code: US
Dates of Applications: 18th December 1991 and 16th April 1992 respectively

Address for service is:
SHELSTON WATERS
55 Clarence Street
SYDNEY NSW 2000

Attorney Code: SW

DATED this 11th Day of November, 1992
ORTHO PHARMACEUTICAL CORPORATION

by

Fellow Institute of Patent Attorneys of Australia
of SHELSTON WATERS

S 034140 111292

To: The Commissioner of Patents
WODEN ACT 2606

File: 16771
Fee: $317.00

MCN 618/651 AUL

AUSTRALIA
PATENTS ACT 1990

WE **ORTHO PHARMACEUTICAL CORPORATION**

OF U.S. Route 202, Raritan, New Jersey 08869-0602

being the Applicant and Nominated Person request the grant of a patent for an invention entitled A PROCESS FOR PREPARING 2-CHLORO-2'-DEOXYADENOSINE which is described in the accompanying standard complete specification.

Convention priority is claimed from the following basic applications:

BASIC APPLICANT	APPLICATION NUMBER	APPLICATION DATE	COUNTRY	COUNTRY CODE
ROBERT H. K. CHEN and	810,992	18 December 1991	United States	US
ROBERT H. K. CHEN	869,689	16 April 1992	United States	US

ROBERT H. K. CHEN is/are the actual inventor(s) of the invention.

The inventor(s) assigned his/their entire rights in the invention to ORTHO PHARMACEUTICAL CORPORATION on December 17, 1991 and April 15, 1992.

The basic applications above were the first applications made in a Convention country in respect of the invention the subject of this request.

Our address for service is

Attorney Code:

DATED this 19 day of November 1992

Signed Benjamin F. Lambert
(for and on behalf of Applicant)

Name: BENJAMIN F. LAMBERT

Title: Assistant Secretary

AU9230122

(12) PATENT ABRIDGMENT (11) Document No. AU-B-30122/92
(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. 653457

(54) Title
A PROCESS FOR PREPARING 2-CHLORO-2'-DEOXYADENOSINE

International Patent Classification(s)
(51)[5] **C07H 019/173 C07F 007/18 C07H 023/00**

(21) Application No. : **30122/92** (22) Application Date : **11.12.92**

(30) Priority Data

(31) Number	(32) Date	(33) Country
810992	**18.12.91**	**US UNITED STATES OF AMERICA**
869689	**16.04.92**	**US UNITED STATES OF AMERICA**

(43) Publication Date : **01.07.93**

(44) Publication Date of Accepted Application : **29.09.94**

(71) Applicant(s)
ORTHO PHARMACEUTICAL CORPORATION

(72) Inventor(s)
ROBERT H.K. CHEN

(74) Attorney or Agent
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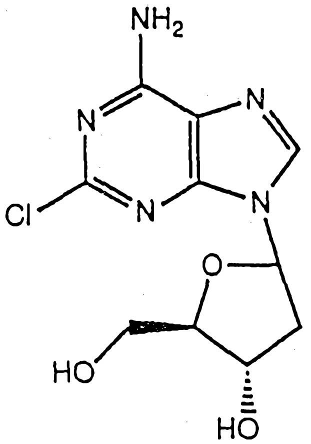
(56) Prior Art Documents
AU 651569 71798/91 C07H
EP 173059
US 4760137

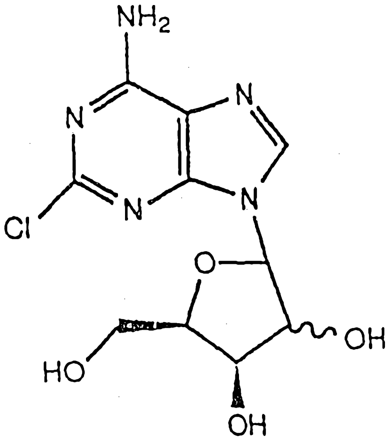
(57) Claim

1. A process for preparing a compound of the following formula

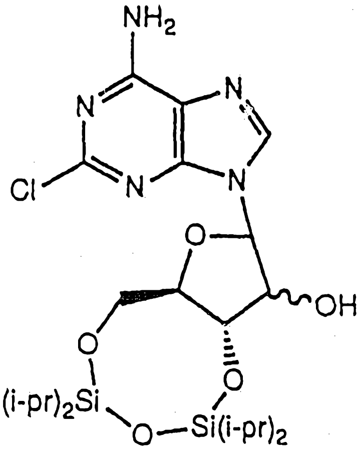


comprising the steps of:

(a) reacting a compound of the following formula

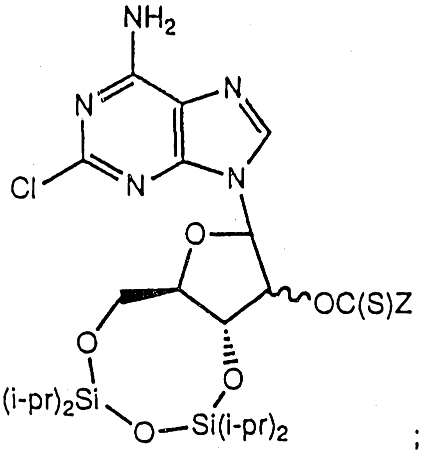


with a silating agent of the formula $(i\text{-pr})_4Si_2O(X)_2$ wherein X is chloro or bromo in the presence of a base to yield a compound of the following formula

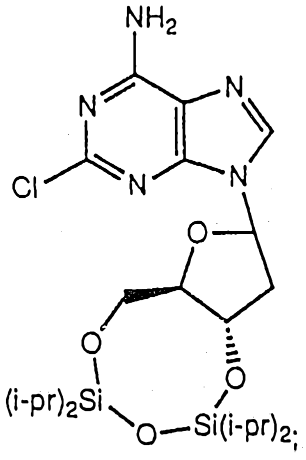


;

(b) acylating the resultant compound of step (a) with an acylating agent of the formula XC(S)Z wherein X is as defined above; Z is R^2 or YR^2; Y is O or S; and R^2 is a C_{1-5} straight- or branched-chain alkyl or phenyl, in the presence of a base to yield a compound of the following formula



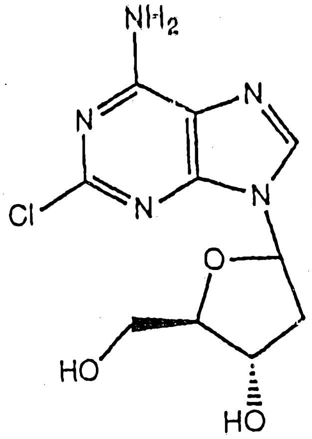
(c) reacting the resultant compound of step (b) with an organotin hydride and a radical initiator to yield a compound of the following formula



and

(d) desilating the resultant compound of step (c) to yield the compound of the following formula

.../4


NH2
N
N
N
N
Cl
O
HO
HO

653457

AUSTRALIA

PATENTS ACT 1990

COMPLETE SPECIFICATION

FOR A STANDARD PATENT

ORIGINAL

Name of Applicant: ORTHO PHARMACEUTICAL CORPORATION

Actual Inventor: Robert H.K. Chen

Address for Service: SHELSTON WATERS
55 Clarence Street
SYDNEY NSW 2000

Invention Title: "A PROCESS FOR PREPARING 2-CHLORO-2'-DEOXYADENOSINE"

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

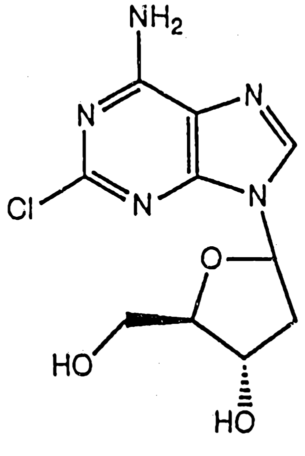
A PROCESS FOR PREPARING 2-CHLORO-2'-DEOXYADENOSINE

CROSS-REFERENCE TO RELATED APPLICATION

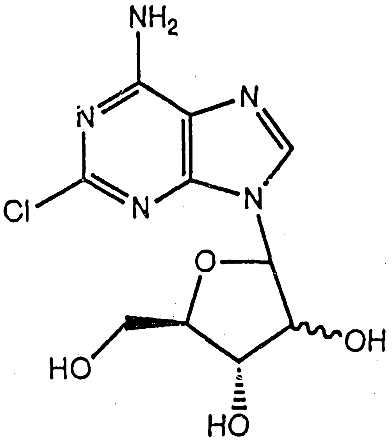
This application is a continuation-in-part of co-pending application Serial No. 810,992, field December 18, 1991.

I. FIELD OF THE INVENTION

This invention relates to a novel process for preparing 2-chloro-2'-deoxyadenosine (2-CdA) having the following formula



from a compound of the following formula



The invention also relates to novel intermediates useful in the preparation of 2-CdA.

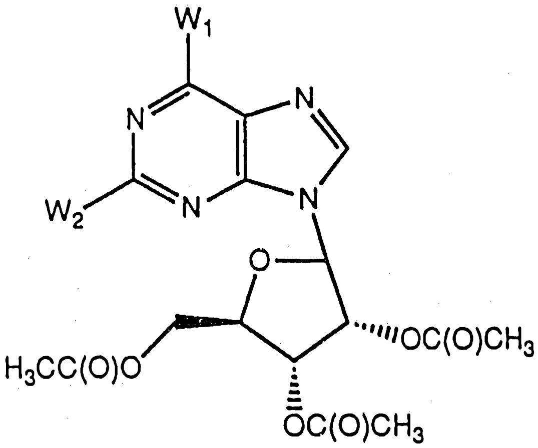
2-CdA is useful as an antileukemic agent, i.e., in treating leukemias, such as hairy cell leukemia and L 1210 leukemia.
2-CdA is also known to have immunosuppressive activity.

II. BACKGROUND OF THE INVENTION

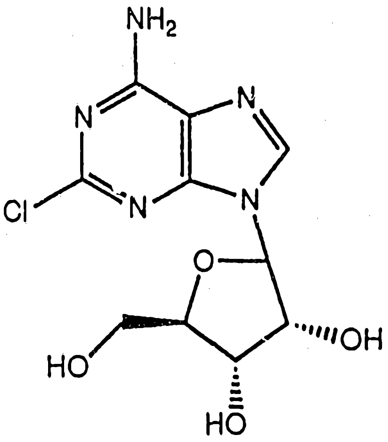
Processes for preparing 2-CdA are known. European Patent Application No. 173,059 A2 and R. Robins *et al.*, *J. Am. Chem. Soc.*, 106, 6379 (1984) disclose the preparation of 2-CdA. The preparation consists of the glycosylation of 2,6-dichloropurine with 1-chloro-2'-deoxy-3',5'-di-O-*p*-toluoyl-b-D-*erythro*-pentofuranose to yield the N-9 glycosylated purine, 2,6-dichloro-9-(2-deoxy-3,5-di-O-*p*-toluoyl-b-D-*erythro*-

pentofuranosyl)purine, which is subsequently reacted with ammonia to yield 2-CdA. The synthesis of 2-CdA by this process, however, has several drawbacks. First, the 2,6-dichloropurine is a costly commercial intermediate. Second, the glycosylation of the 2,6-dichloropurine yields an N-7 glycosylated side product, 2,6-dichloro-7-(2-deoxy-3,5-di-O-p-toluoyl-β-D-erythro-pentofuranosyl)purine, that has to be separated from the desired N-9 glycosylated product.

Processes are also disclosed for preparing compounds having the following formula

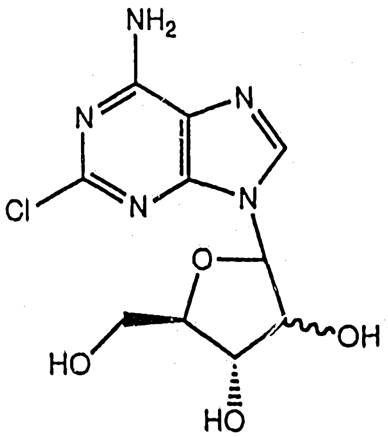


wherein W^1 is Cl or NH_2, and W^2 is Cl or NH_2, from the natural nucleoside guanosine (See, M. Robins et al., Can. J. Chem., 59, 2601 (1981); M. Robins et al., Nuc. Acids Symp. Ser., 9, 61 (1981). M. Robins et al., Can. J. Chem., 59, 2601 (1981) also disclose a process for preparing a compound of the formula



by reacting the aforesaid compound wherein W^1 and W^2 are Cl with ammonia in a protic solvent such as water or an alcohol. However, these publications do not disclose or suggest a method for effecting the 2-deoxygenation of these compounds.

In addition, processes are disclosed for effecting the 2'-deoxygenation of compounds of the following formula

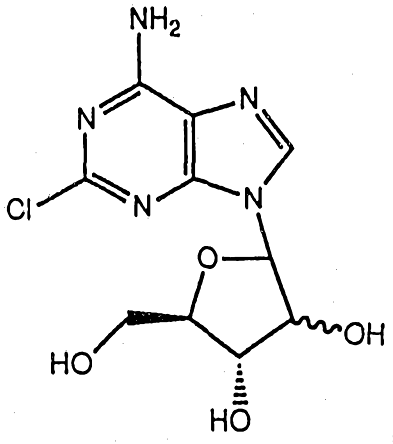


(See, M. Robins et al., J. Am., Chem. Soc., 103, 932 (1981); M. Robins et al., J. Am. Chem. Soc., 105, 4059 (1983)). These publications, however, do not disclose or suggest a process for converting a nucleoside having a halo substituent in the nucleotide moiety to their corresponding 2'-deoxygenated nucleosides. Furthermore, it is disclosed that the steps that are used to effect the deoxygenation are not applicable where the starting nucleoside has a halogenated nucleotide moiety, i.e., such a nucleoside cannot be converted to the corresponding 2-deoxygenated nucleoside due to the presence of the halo substituent. R. Robins et al., J. Am. Chem. Soc., 106, 6379 (1984); J. Montgomery, In "Nucleosides, Nucleotides, and their Biological Applications", J. Rideout, D. Henry, M. Beecham; Eds.; Academic Press: New York, p.p. 19-46 (1983).

Consequently, none of the aforesaid publications disclose a process for preparing 2-CdA from a starting material other than 2,6-dichloropurine. In addition, the publications do not disclose a process for preparing 2-CdA that does not require a glycosylating reaction step or the separation of isomeric N-glycosylated products. Furthermore, there is no disclosure of the preparation of 2-CdA starting from a 2'-oxygenated nucleoside.

III. SUMMARY OF THE INVENTION

The present invention relates to a novel process for preparing 2-CdA from a compound of the following formula

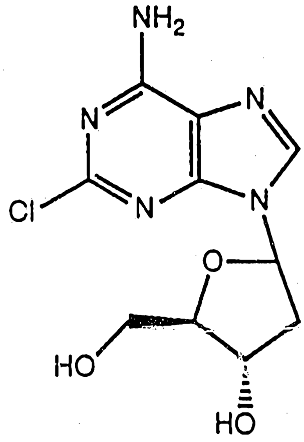


,

which process comprises the steps of silating the hydroxyl groups of the compound at the 3' and 5' positions, acylating the hydroxyl group at the 2' position, deoxygenating the acylated 2' position and desilating the hydroxyl groups at the 3' and 5' positions.

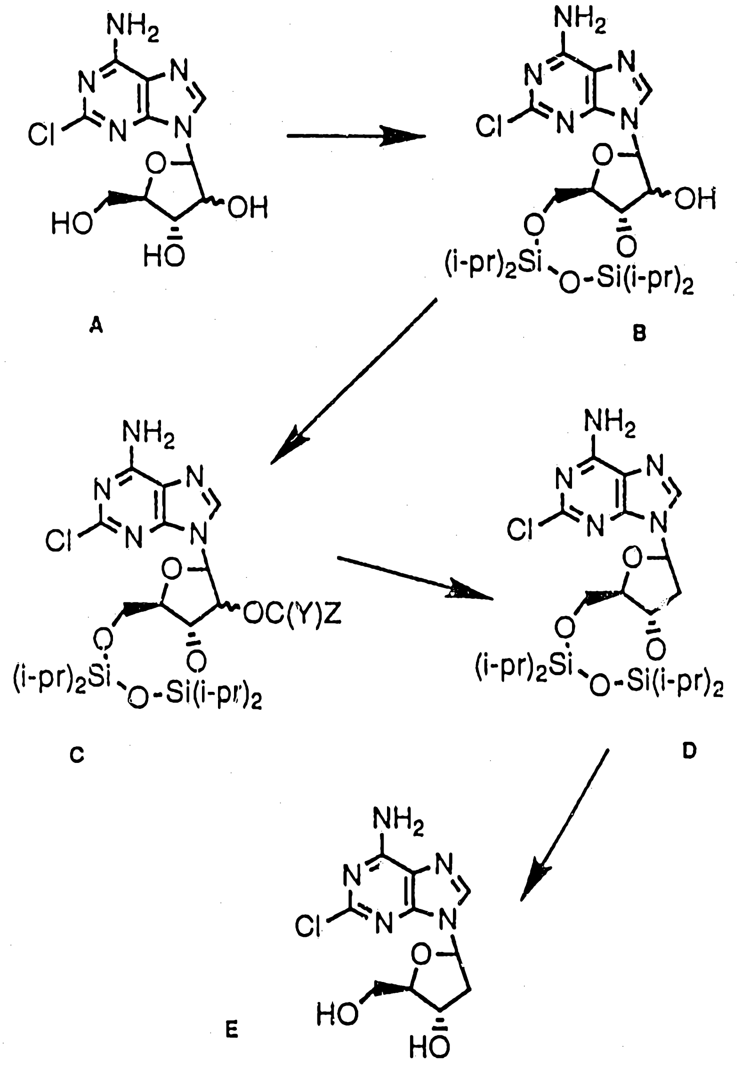
IV. DETAILED DESCRIPTION OF THE INVENTION

The invention in its broadest aspects relates to a novel process for preparing the compound 2-CdA having the following formula



Scheme I discloses the process of the invention for preparing 2-CdA. The process employs as the starting material a 2'-oxygenated nucleoside, compound A wherein the 〰 bond at the 2 position denotes that the hydroxyl attached at that position can be down (─▤), up (─◀) or mixtures thereof.

SCHEME I



In the first step of the process, compound B is prepared by reacting compound A with a silating agent in the presence of a base such as pyridine. The silating agent has the formula $(i\text{-pr})_4Si_2O(X)_2$, wherein X is a halo, such as 1,3-dichloro-1,1,3,3-tetraisopropyl disiloxane. The reaction takes from about 1 to 6 hours, at about room temperature or reflux, and the reaction is carried out under dry atmospheric conditions such as N_2 or argon to prevent the hydrolysis of the silating agent.

In the second step of the process, compound C is prepared by acylating compound B with an acylating agent in the presence of an organic base such as 4-dimethylaminopyridine, or an inorganic base such as an alkali hydroxide or carbonate, e.g., Na_2CO_3 or KOH, in water. The acylating agent has the formula, XC(S)Z, wherein X as defined above, Z is YR^2 or R^2 , Y is S or O, and R^2 is a C_{1-5} straight- or branched-chain alkyl, phenyl or substituted phenyl where the substituents are chloro or methyl; preferably phenyl chlorothionoformate. A strong base should be employed where Z is YR^2. However, the reaction can be carried out under basic aqueous conditions as noted above. The reaction is carried out preferably in an organic solvent such as methylene chloride or acetonitrile under dry atmospheric conditions as described above to prevent the hydrolysis of the acylating agent. The reaction is carried out at about room temperature to 80 °C, and for about 1 to 16 hours.

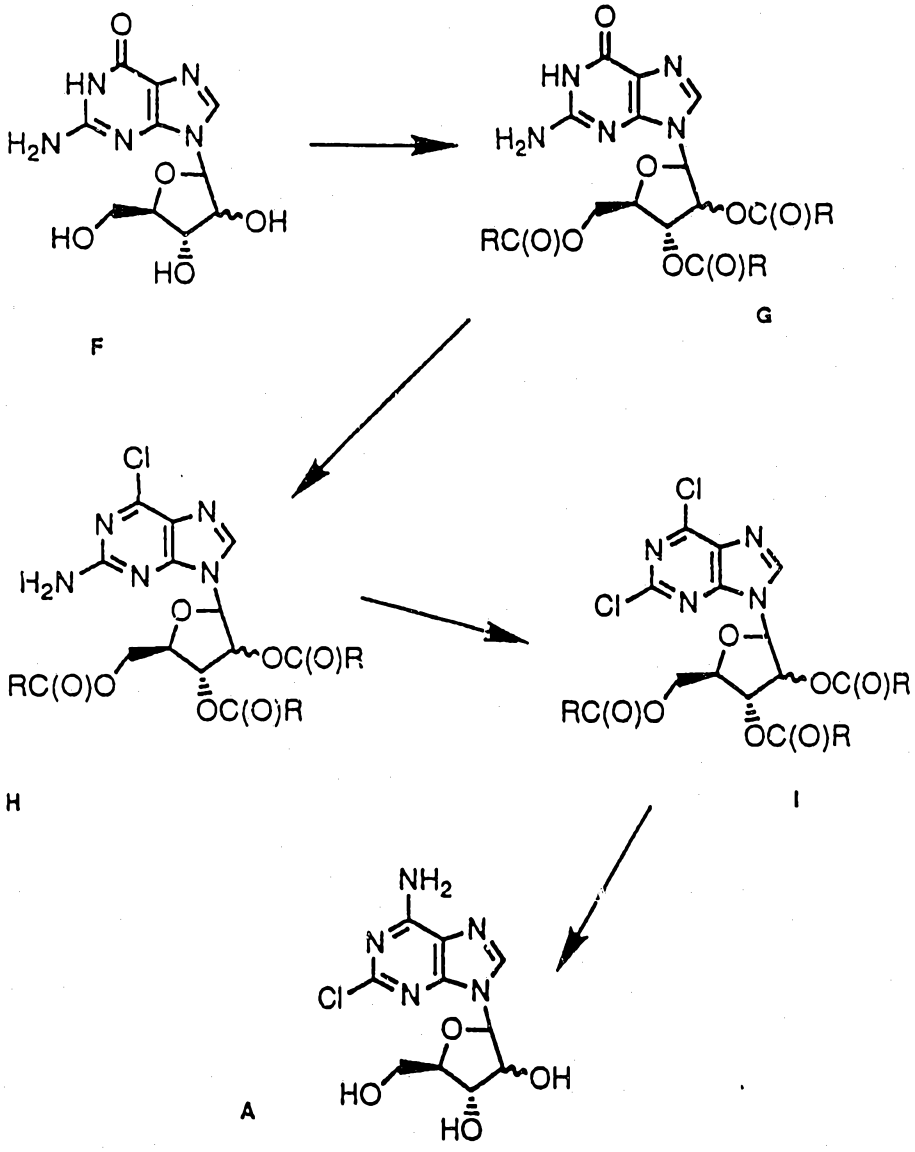
In the next step, compound C is reacted with an organotin hydride such a tri-n-butyltin hydride or triphenyltin hydride, and a radical initiator such as, for example, azobisisobutyronitrile, 4,4-azobis(4-cyanovaleric acid), or azobis(1-cyanocyclohexane) to yield compound D. The reaction is carried out in a solvent such as benzene or toluene, at a temperature of from about 60 °C to reflux, for about 1 to 10 hours, and the reaction is preferably carried out under dry atmospheric conditions as described above.

The last step of the process, involves desilating compound D to yield 2-CdA (E). The desilation is carried out under hydrolysis conditions, e.g., using an acid or a base such as dilute to 6N HCl or dilute to 6 N NaOH, in a solvent such as dioxane, water, or a straight- or branched-chain C_{1-4} alcohol (methanol, isopropanol or butanol). In the alternative, the desilation is preferably carried out in the presence of a fluoride source such as tetra-n-butylammonium fluoride, sodium fluoride or potassium fluoride, in a solvent such as tetrahydrofuran or ether, and under dry atmospheric conditions as described above. The desilation is carried out at about room temperature to 60 °C, for about 1 to 2 hours.

The present invention is further directed to the novel intermediates compounds B, C and D, as shown in Scheme I. The intermediates are useful in the production of 2-CdA.

The preparation of the starting material, compound A, from guanosine, a natural 2'-oxygenated nucleoside, or an analogue or derivative thereof is shown in Scheme II.

SCHEME II



The preparation of guanosine, compound F wherein the 2'-hydroxy is down, is disclosed by P. Levine et al., Nucleic Acids, p. 163 (New York, 1931) and J. Davoll, Chem. Soc., 1593 (1958). The preparation of the analogue of guanosine, i.e., compound F wherein the 2'-hydroxy is up, is disclosed by J. Med. Chem., 25(6), 1899 (1988).

Compounds G and H, which are derivatives of compound F, are prepared essentially according to the method disclosed by M. Robins et al., Can. J. Chem., 99, 2601 (1981). The preparation of compound G, wherein R is a C_{1-5} straight- or branched-chain alkyl or phenyl, involves the acylation of compound F with an appropriate acylating agent. The preparation of compound H involves reacting compound G with an inorganic acid chloride.

Compound I is then prepared essentially according to the method disclosed by M. Robins et al., Nuc. Acids Symp. Ser., 9, 61 (1981). In this method, compound H is reacted with a nitrosylating agent, e.g., alkyl nitrite, and a chloride source, e.g., alkyl chloride or arylalkyl chloride.

Compound A is then prepared essentially as described by M. Robins et al., Can. J. Chem., 59, 2601 (1981), i.e., by reacting compound I with ammonia or ammonium hydroxide.

The compound 2-CdA is useful as an antileukemic agent, i.e., in treating leukemias, such as hairy cell leukemia and L1210 leukemia. 2-

CdA is also known to have immunosuppressive activity. See, D. Carson et al., Proc. Natl. Acad. Sci. USA, 81, 2232 (1984).

The following examples describe the invention in greater particularity and are intended to be a way of illustrating but not limiting the invention.

V EXAMPLES

Example 1: Preparation of 2',3',5'-O-triacetyl guanosine

A mixture of guanosine (355 g, 1.25 M), acetic anhydride (0.750 L), pyridine (0.375 L) and dimethylformamide (1 L) is stirred at room temperature for 2 hours and then heated at 75°C for 4 hours. After the heating, the mixture is cooled to room temperature and stirred overnight Most of the solvent is then removed by vacuum distillation at 45°C to yield a white precipitate. The solid is isolated by filtration and washed with isopropanol. The solid is suspended in isopropanol, and heated to reflux whereupon most of the solid dissolves. The isopropanol is then allowed to cool to room temperature, and filtered to yield a white solid that is dried overnight in a vacuum oven at 60°C to yield the title compound (358 g, 69.8%).

Example 2: Preparation of 9-(2',3',5'-O-triacetyl-b-D-ribofuranosyl)-2-amino-6-chloropurine

A mixture of the compound of Example 1 (480 g, 1.17 M), N,N-dimethylaniline (150 mL), tetraethylammonium chloride (386.4 g) and acetonitrile (0.70 L) is prepared, and then phosphorous oxychloride (400 mL) is added slowly (dropwise) over 3 hours at room temperature under a N_2 atmosphere. After the addition, the mixture is heated at 100°C for 14 minutes, and then cooled to room temperature. Most of the solvent is removed in vacuo to yield a red oil. The oil is treated with methylene chloride (CH_2Cl_2) (2 L), and then poured into ice water (1.5 L). The organic layer is separated and the aqueous layer extracted with CH_2Cl_2 (3 x 500 mL). The separated organic layer and the organic extracts are combined, washed with a saturated sodium bicarbonate solution until a pH of 6 to 7 is reached, and then washed with ice-water (2 x 1 L). The organic layer is dried over sodium sulfate, and the solvent removed in vacuo to yield a thick oil. The oil is treated with isopropanol (200 mL), stirred at 45°C for 1 hour, allowed to cool to room temperature, and left overnight whereupon a precipitate is formed. The precipitate is isolated by filtering and then the precipitate is washed with cold isopropanol to yield the title compound (235 g, 47 %).

Example 3: Preparation of 9-(2',3',5'-O-triacetyl-b-D-ribofuranosyl)-2,6-dichloropurine

n-Pentyl nitrite (98 g, 838 mM) is added over one hour at room temperature under nitrogen to a mixture of the compound of Example 2 (350 g, 819 mM), triphenylmethyl chloride (500 g, 1.79 M) and potassium carbonate (65 g) in CH_2Cl_2 (3 L). The resulting mixture is heated at reflux for 20 minutes, cooled to room temperature and filtered. The filtrate is concentrated in vacuo, and the resulting residue is purified by column chromatography on silica gel (2.5 kg, ethyl acetate/hexane 1:4-3:7) to yield the title compound as a pale yellow solid (272 g, 74 %).

Example 4 Preparation of 2-chloroadenosine

A mixture of the compound of Example 3 (271 g, 606 M), concentrated ammonium hydroxide (4 L) and tetrahydrofuran (0.5 L) is stirred at room temperature under nitrogen for 4 days. The solvent volume is reduced in vacuo and the resulting residue is triturated with absolute ethanol. The title compound is precipitated out of the ethanolic solvent to yield a light brown solid, (159 g, 87%).

Example 5: Preparation of 2-chloro-(3',5'-O-tetraisopropyldisiloxyl)adenosine

A mixture of the compound of Example 4 (13 g, 43 mM), 1,3-dichloro-1,1,3,3-tetraisopropyldisiloxane (15 g, 47.6 mM) and pyridine (150 mL) is stirred at room temperature under nitrogen for 3 hours. The solvent volume is reduced in vacuo and the resulting residue is dissolved in CH_2Cl_2 (250 mL), washed with a saturated copper sulfate solution (2 x 150 mL) and dried with sodium sulfate. The organic layer is concentrated in vacuo and purified by column chromatography on silica gel (200 g) with ethyl acetate/hexane (1:1) to yield the title compound as a white powder (14.7 g, 63%, mp 198-200°C); ^1H-NMR ($CDCl_3$) : δ 7.9 (s, 1H, C_8H), 6.32 (bs, 2H, NH_2), 5.89 (s, 1H, $C_{1'}H$); IR (KBr) : 3400, 1650, 1595, 1040 cm^{-1}.

Anal. Calcd. for $C_{22}H_{38}ClN_5O_5Si_2$: C, 48.55; H, 7.04; N, 12.87
Found: C, 48.66; H, 6.81; N, 12.71

Example 6 Preparation of 2-chloro-2'-O-phenoxythiocarbonyl-(3',5'-O-tetraisopropyldisiloxyl)adenosine

Phenyl chlorothionoformate (4.66 g, 27 mM) is added to a mixture of the compound of Example 5 (14 g, 25.8 mM), 4-dimethylaminopyridine (DMAP) (6.88 g, 56.4 mM) and acetonitrile (400 mL) at room temperature under nitrogen, and stirred overnight. The solvent is removed in vacuo and the residue is purified by column chromatography on silica gel (200 g) with ethyl acetate/hexane (4:6) to yield the title compound as a pale yellow powder (9.8 g, 56%, mp 153-155°C); ^1H-NMR($CDCl_3$): δ 7.9 (s, 1H, C_8H), 7.1~7.5 (m, 5H, aromatic protons); IR (KBr) : 1640, 1590, 1200 cm^{-1}.

Anal. Calcd. for $C_{29}H_{42}ClN_5O_6SSi_2$: C, 51.19; H, 6.22; N, 10.29
Found: C, 51.11; H, 6.50; N, 10.21

Example 7: Preparation of 2-chloro-2'-deoxy-(3',5'-O-tetraisopropyldisiloxyl)adenosine

A mixture of the compound of Example 6 (5.8 g, 8.54 mM), tri-n-butyltin hydride (3 mL, 11 mM) and azobisisobutyronitrile (320 mg) in benzene (100 mL) is heated to reflux for 3 hours under nitrogen. After cooling, the solvent is removed in vacuo and the residue is purified by column chromatography on silica gel (200 g) with ethyl acetate/hexane

(4.5:5.5) to yield the title compound as a white powder (3.78 g, 84 %, mp 171-173°C)

^{1}H-NMR ($CDCl_3$) : δ 7.95 (s, 1H, C_8H), 6.43 (bs, 2H, NH_2); IR (KBr) : 3350, 3180, 1660, 1597, 1310 cm^{-1}.

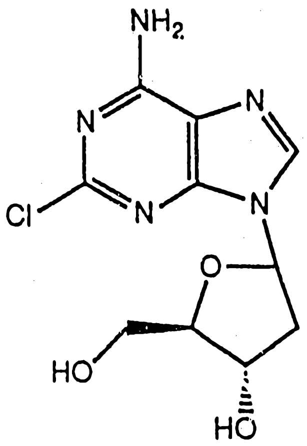
Anal. Calcd. for $C_{22}H_{38}ClN_5O_4Si_2$:	C, 50.02; H, 7.25; N, 13.26
Found:	C, 50.41; H, 7.41; N, 12.85

Example 8: Preparation of 2-chloro-2'-deoxy-adenosine

A mixture of the compound of Example 7 (2.5 g, 4.74 mM), and tetra-n-butylammonium fluoride in tetrahydrofuran (1.1 M, 8.6 mL, 9.46 mM) in tetrahydrofuran (10 mL) is stirred at room temperature under nitrogen for 2 hours. The solvent volume is reduced in vacuo and the resulting residue is treated with water (200 mL) and extracted with ether (3 x 20 mL). The aqueous layer is purified by preparative HPLC (C-18 reverse phase column, methanol/water 15:85 to 20:80) to yield the title compound (600 mg, 44%, mp >230°C).

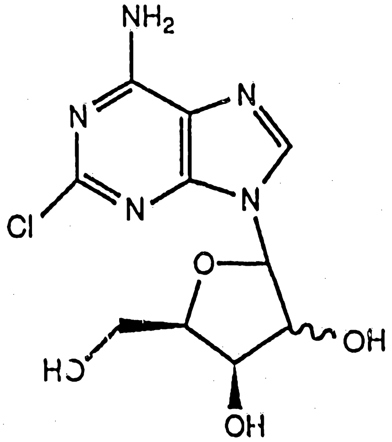
THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:-

1. A process for preparing a compound of the following formula

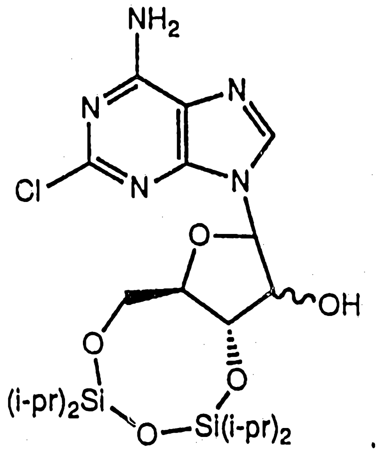


comprising the steps of:

(a) reacting a compound of the following formula



with a silating agent of the formula $(i\text{-pr})_4Si_2O(X)_2$ wherein X is chloro or bromo in the presence of a base to yield a compound of the following formula



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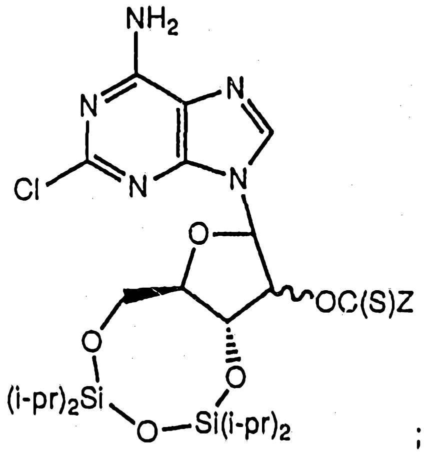
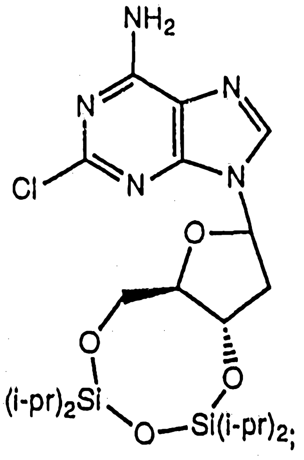
(b) acylating the resultant compound of step (a) with an acylating agent of the formula XC(S)Z wherein X is as defined above; Z is R^2 or YR^2; Y is O or S; and R^2 is a C_{1-5} straight- or branched-chain alkyl or phenyl, in the presence of a base to yield a compound of the following formula



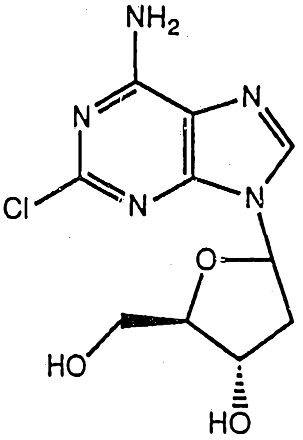
;

(c) reacting the resultant compound of step (b) with an organotin hydride and a radical initiator to yield a compound of the following formula



and

(d) desilating the resultant compound of step (c) to yield the compound of the following formula



2. The process of claim 1 wherein the silating agent is a 1,3-dihalo-1,1,3,3-tetraisopropyldisiloxane.

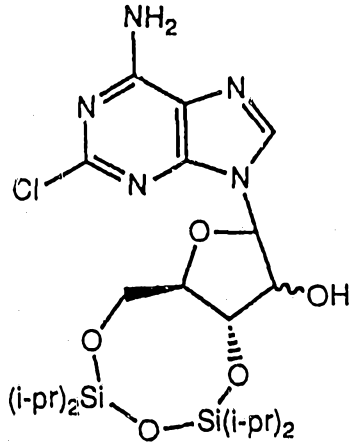
3. The process of claim 2 wherein the 1,3-dihalo-1,1,3,3-tetraisopropyldisiloxane is 1,3-dichloro-1,1,3,3-tetraisopropyldisiloxane.

4. The process of claim 1 wherein in step (b) the acylating agent is phenyl chlorothionoformate.

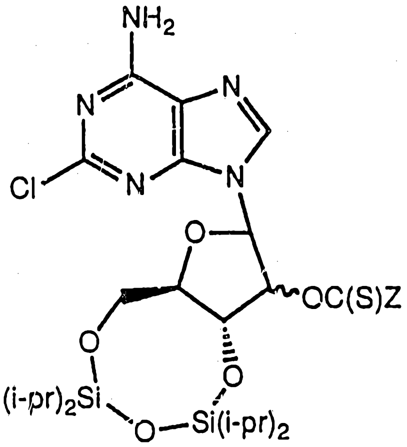
5. The process of claim 1 wherein in step (b) the base is 4-dimethylaminopyridine.

6. The process of claim 1 wherein the radical initiator is azobisisobutyronitrile.

7. A compound of the following formula



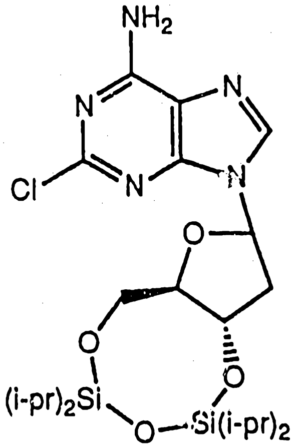
8. A compound of the following formula



,

wherein Z is R^2 or YR^2; Y is O or S; and R^2 is a C_{1-5} straight- or branched-chain alkyl or phenyl.

9. A compound of the following formula



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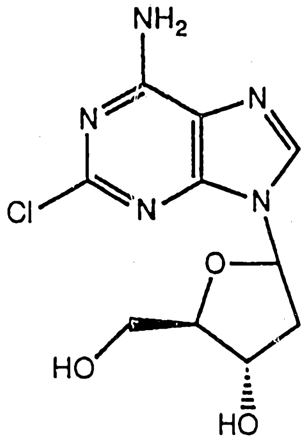
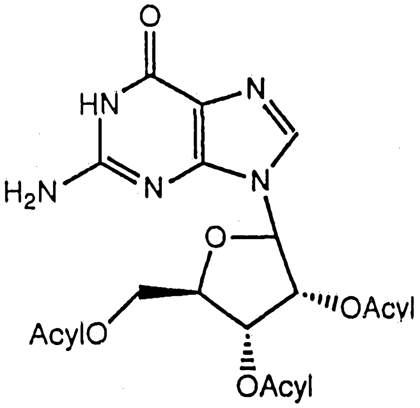
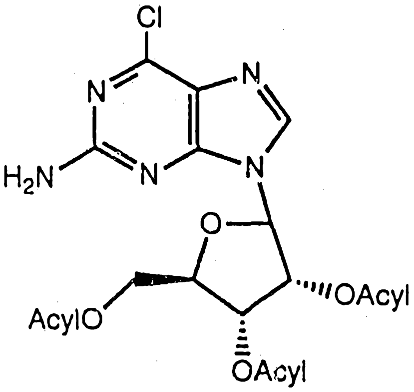
10. A process for preparing a compound of the following formula



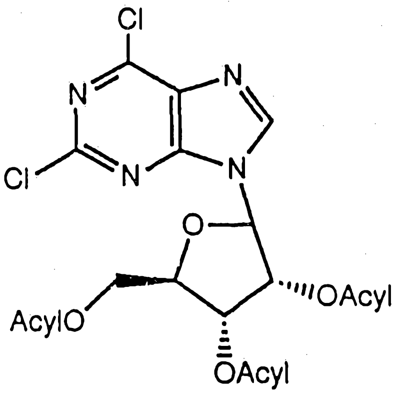
(a) acylating guanosine to yield a compound of the formula



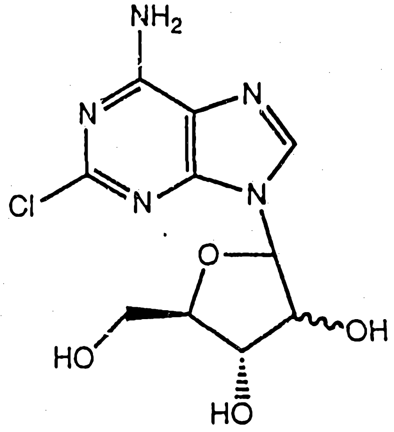
(b) reacting the compound of step (a) with a chlorinating agent to yield a compound of the formula



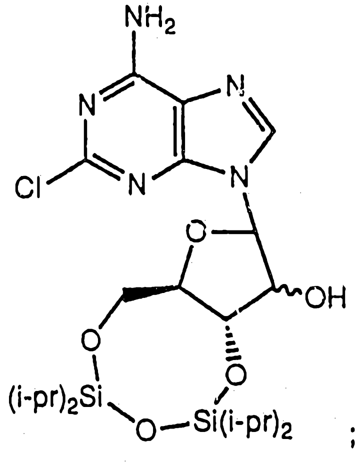
(c) reacting the compound of step (b) with a nitrosylating agent and a chlorinting agent and to yield a compound of the formula



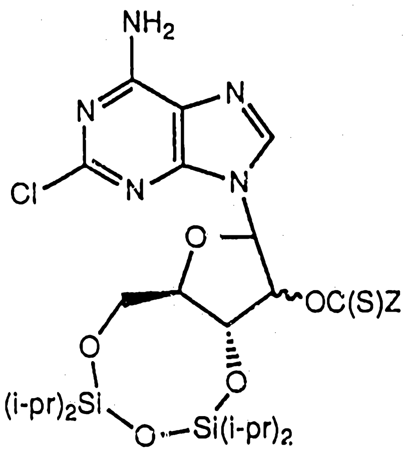
(d) reacting the compound of step (c) with ammonia or ammonium hydroxide to yield the following compound



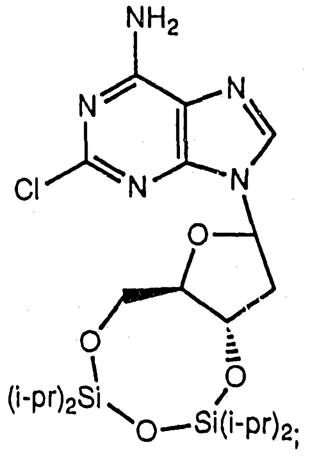
(e) reacting the compound of step (d) with a silating agent of the formula (i-pr)$_4$Si$_2$O(X)$_2$ wherein X is chloro or bromo in the presence of a base to yield a compound of the following formula


;

(f) acylating the resultant compound of step (e) with an acylating agent of the formula XC(S)Z wherein X is as defined above; Z is R^2 or YR^2; Y is O or S; and R^2 is a C_{1-5} straight- or branched-chain alkyl or phenyl, in the presence of a base to yield a compound of the following formula

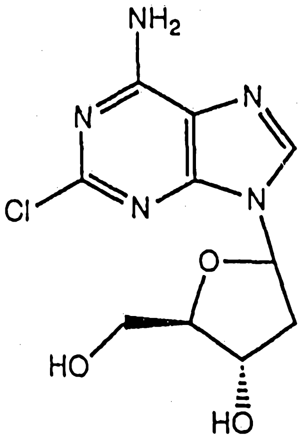


(g) reacting the resultant compound of step (f) with an organotin hydride and a radical initiator to yield a compound of the following formula



and

(h) desilating the resultant compound of step (g) to yield the compound of the following formula



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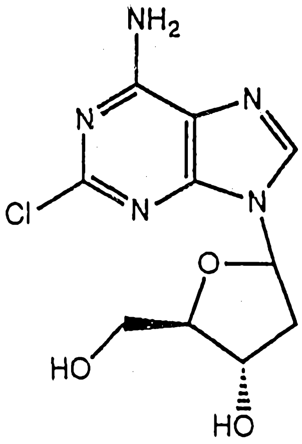
DATED this 11th Day of December, 1992

ORTHO PHARMACEUTICAL CORPORATION

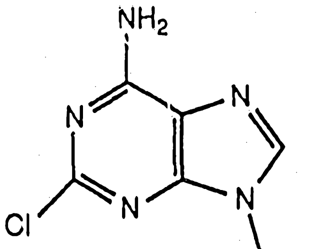
Attorney: IAN ERNST
Fellow Institute of Patent Attorneys of Australia
of SHELSTON WATERS

ABSTRACT

This invention relates to a novel process for preparing 2-chloro-2'-deoxyadenosine (2-CdA) having the following formula



from a compound of the following formula



The invention also relates to intermediates which are useful in preparing 2-CdA. The compound 2-CdA is useful as an antileukemic agent, i.e., in treating leukemias, such as hairy cell leukemia.