The compounds of Formula I are prodrugs of CETP inhibitors having a central oxazolidinone ring. The compounds cyclize by the elimination ofHX to form an oxazolidinone ring after administration to a patient.
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TITLE OF THE INVENTION
PRODRUGS OF OXAZOLIDINONE CETP INHIBITORS

FIELD OF THE INVENTION

This invention relates to prodrugs of oxazolidinone compounds which are CETP inhibitors.

BACKGROUND OF THE INVENTION

Atherosclerosis and its clinical consequences, coronary heart disease (CHD), stroke and peripheral vascular disease, represent a truly enormous burden to the health care systems of the industrialized world. In the United States alone, approximately 13 million patients have been diagnosed with CHD, and greater than one half million deaths are attributed to CHD each year. Further, this toll is expected to grow over the next quarter century as the average age of the population increases and as an epidemic in obesity and diabetes continues to grow.

Inhibition of cholesteryl ester transfer protein (CETP) is a potential new approach to reducing the incidence of atherosclerosis. Statins, which are widely used to help control cholesterol, are effective in reducing LDL-cholesterol (the "bad cholesterol") in patients, and are relatively less effective in raising HDL-cholesterol ("the good cholesterol"). CETP inhibitors are effective in raising HDL-cholesterol and may also reduce LDL-cholesterol. CETP inhibitors therefore represent a potential new tool for controlling lipids and for treating or reducing CHD and atherosclerosis in the general population, either alone or in combination with a statin. A combination of a CETP inhibitor and a statin may be especially advantageous in controlling lipids by raising HDL-C and reducing LDL-C.

Pfizer's torcetrapib is the only CETP inhibitor that has so far been tested in a large-scale clinical trial. The trial (named ILLUMINATE) was stopped before its scheduled completion date, because the patients being treated with torcetrapib and atorvastatin in combination had a higher incidence of mortality than the control group, which was being treated only with atorvastatin. Data generated after the termination of the ILLUMINATE trial using animal studies and further data analysis suggest that the higher incidence of mortality in the patient group treated with torcetrapib may have been due to off-target effects of the molecule rather than the mechanism of action. Studies of other CETP inhibitors are therefore expected to occur, and new compounds are still being investigated. Studies of two CETP inhibitors, dalcetrapib and anacetrapib, are starting or are in progress.

CETP inhibitors are generally lipophilic, having poor solubility in water and in aqueous bodily fluids. Oral formulations of the poorly soluble CETP inhibitors using conventional tablet formulations have limited aqueous solubility and generally exhibit a "food effect," whereby the amount of drug that is absorbed varies, depending on whether the patient
takes the drug with a meal or in a fasted state. Efforts have been made to develop formulations that have better bioavailability. A potent class of substituted oxazolidinones, imidazolidinones, and other similar 5-membered heterocycles (see WO 2006/014357 and WO 2006/014413) was recently disclosed. As was observed with other CETP inhibitors, the compounds have poor water solubility. A particularly active compound that is disclosed in these applications is anacetrapib, which is the oxazolidinone compound pictured herein as compound III. Liquid formulations of the oxazolidinone compounds in surfactants (WO2007/067593) and solid formulations of the oxazolidinone compounds in water soluble polymers (WO2007/092642) have been developed that provide improved solubility and bioavailability compared with conventional formulations of the drugs.

This application discloses an alternative approach to improving the oral availability of the drugs. Prodrugs are disclosed which are easy to administer and which are converted to the active drug in vivo. With the prodrugs of the oxazolidinone compounds that are described in this application, the oxazolidinone ring is formed by a cyclization reaction which forms the active drug after administration to a patient. A somewhat analogous approach has been disclosed in which a 5-membered heterocycle is produced as a by-product of a coupling reaction: W.S. Saari et al, J Med. Chem., 1990, 33, pp. 97-101.

SUMMARY OF THE INVENTION

The present invention provides a prodrug having formula I:

![Formula I](image)

The compound of Formula I is a prodrug which readily converts to the compound having Formula II when it is administered to a patient. The prodrug is most often administered orally, though other routes of administration may also be used. The prodrug converts to the active drug during or after administration, generally after administration. The compound of formula I is converted to the active oxazolidinone compound of formula II by a cyclization reaction or reactions in which the N and carbonyl are joined together to form the 5-membered oxazolidinone ring of the compound of formula II.
In the compounds having Formula I and Formula II:

R₁ is H or Ci₄alkyl, which is optionally substituted with 1-5 F groups;

Each R₂ is independently selected from the group consisting of halogen, -CN, Ci₄alkyl, and -OCi₄alkyl, wherein Ci₄alkyl and -OCi₄alkyl are optionally substituted with 1-5 halogens;

R₄ and R₅ are each independently selected from the group consisting of halogen, Ci₄alkyl, and -OCi₄alkyl, wherein Ci₄alkyl and -OCi₄alkyl are optionally substituted with 1-5 halogens;

R₃ is selected from H, halogen, Ciᵃalkyl, and -OCi₄alkyl, wherein Ciᵃalkyl and -OCi₄alkyl are optionally substituted with 1-5 halogens;

a and b are integers which are each independently selected from from 0-4; and c is an integer from 0-2.

In the prodrug of Formula I, X is a leaving group which is displaced by the N during the cyclization reaction in which I is converted to II.

X has the structure -OZ or -SZ, wherein:

Z is selected from

(a) Ci-Cs alkyl which optionally includes an -O- atom between 2 adjacent carbon atoms, wherein said C₁-C₅ alkyl is optionally substituted with 1-5 halogens and is optionally substituted with 1-2 substituent groups independently selected from phenyl, -C(=O)OR₆, _0P(=O)(OR₇), and -P(=O)(OR₇), wherein phenyl is optionally substituted with 1-3 groups independently selected from halogen, -C(-O)OR₇, and Ci-C₅alkyl optionally substituted with 1-3 halogens; and

(b) phenyl, wherein phenyl is optionally substituted with 1-3 groups

independently selected from halogen; Ci-C₅alkyl; -OCs-C₅alkyl; -C(=O)OR₇; and C₅
C₇ cycloalkyl optionally substituted with 1-2 groups independently selected from halogen, Q - C₃ alkyl, OCH₃, CF₃, and OCF₃; wherein C₁-C₅ alkyl and -OCF₃ are optionally substituted with 1-5 F and are optionally substituted with 1-2 groups independently selected from -C(O)OR, -N(R)₂, -OP(-O)(OR)₂, and -P(-O)(OR)₂;

R⁶ is selected from H and C₁-C₅ alkyl which is optionally substituted with 1-5 halogens and is optionally substituted with 1-2 phenyl groups wherein phenyl is optionally substituted with 1-3 groups independently selected from halogen, C₁-C₃ alkyl, -OCF₃ alkyl, CF₃, and -OCF₃; and

R⁷ is selected from H and C₁-C₃ alkyl optionally substituted with 1-3 F.

DETAILED DESCRIPTION OF THE INVENTION

In embodiments of the compounds of Formula I and II described above, R¹ is H or C₁-C₃ alkyl, optionally substituted with 1-5 F. R¹ in preferred embodiments is C₁-2 alkyl, optionally substituted with 1-3 F. In other preferred embodiments, R¹ is C₁-2 alkyl. In other preferred embodiments, R¹ is CH₃.

In embodiments of the compound of Formula I and II, each R² is independently selected from -CN, F, C₁-3alkyl optionally substituted with 1-5 F, and -OCF₃ alkyl optionally substituted with 1-5 F. In other embodiments, each R² is independently selected from -CN, F, C₁-3alkyl optionally substituted with 1-5 F, and -OCF₃ alkyl optionally substituted with 1-5F. In preferred embodiments, each R² is independently selected from -CN, C₁-3alkyl, CF₃, -OCH₃, -OCF₃, and F.

In other preferred embodiments, each R² is independently selected from -CN, CH₃ and CF₃. In other preferred embodiments, each R² is CH₃ or CF₃. And in other preferred embodiments, R² is CF₃.

In embodiments of the compound of Formula I and II, R⁴ and R⁵ are each independently selected from F, C₁-3alkyl optionally substituted with 1-5 F, and -OCF₃ alkyl optionally substituted with 1-5 F. In other embodiments, R⁴ and R⁵ are each independently selected from F, C₁-3alkyl optionally substituted with 1-5 F, and -OCF₃ alkyl optionally substituted with 1-5F. In other embodiments, R⁴ and R⁵ are each independently selected from C₁-3alkyl, CF₃, -OCH₃, -OCF₃, and F.
In preferred embodiments, each R₄ is independently selected from Ci-3alkyl, CF₃, -OCH₃, -0CF₃, and F. In other preferred embodiments, each R₄ is independently selected from Ci-3alkyl, CF₃, -OCH₃, and F. In other preferred embodiments, each R₄ is independently selected from Ci-3alkyl, CF₃, -OCH₃, and F.

In embodiments, R³ is Cl-3alkyl, -0Cl-3alkyl, or F, wherein Ci-3alkyl and OCl-3alkyl are optionally substituted with 1-5 F.

In preferred embodiments, R³ is CH₃, CF₃ or F.

In other preferred embodiments, R³ is CF₃.

In preferred embodiments, a is 1 or 2. In other preferred embodiments, a is 2.

In preferred embodiments, b is an integer from 1-3. In other preferred embodiments, b is 2 or 3. In other preferred embodiments, b is 3.

In preferred embodiments, c is 0 or 1. In other preferred embodiments, c is 0.

In some embodiments, Z is selected from

(a) C₁-C₃ alkyl which optionally includes an -O- atom between 2 adjacent carbon atoms, wherein said C₁-C₃ alkyl is optionally substituted with 1-3 F and is optionally substituted with 1-2 substituent groups independently selected from phenyl, -C(=O)OR, -OP(=O)(OR)₂, and -P(=O)(OR)₂, wherein phenyl is optionally substituted with 1-3 groups independently selected from halogen, Ci-C₃alkyl, CF₃, and -C(OR)₂; and

(b) Phenyl, wherein phenyl is optionally substituted with 1-3 groups independently selected from halogen, Ci-Csalkyl, CF₃, -0Cj-Csalkyl, -0CF₃, -C(O)OR, and Cs-C₇cycloalkyl which is optionally substituted with 1-2 groups independently selected from halogen, CH₃, and -OCH₃; wherein Ci-Csalkyl and -0Cj-C₃alkyl are optionally substituted with 1-2 groups independently selected from -C(=O)OR, -N(R)₂, -OP(=O)(OR)₂, and -P(=O)(OR)₂.

In some embodiments, R₆ is selected from H and Ci-C₃alkyl which is optionally substituted with one phenyl group, said phenyl being optionally substituted with 1-3 groups independently selected from halogen, CH₃, CF₃, -OCH₃, and -0CF₃.

In some embodiments, R₇ is selected from H and C₁-C₃ alkyl optionally substituted with 1-3 F.

In some embodiments, X is selected from -SCi-C₃alkyl and -OZ. In some embodiments, X is selected from -SCi-C₂alkyl and -OZ.
In some embodiments, X is -SCi-C2alkyl. In some embodiments, X is -OZ.

In some embodiments, Z is selected from

(a) -(CH2CH2θ -n Ci-C3alkyl, where n is 0 or 1, and wherein Ci-C3alkyl is optionally substituted with 1-2 substituent groups independently selected from phenyl, -C(=O)OR6, -OP(=0)(OR7)2, and -P(=O)(OR7)2, wherein phenyl is optionally substituted with one group -C(=O)OR7; and

(b) phenyl, which is optionally substituted with 1-3 substituents independently selected from C1-C4 alkyl, -OCi-C3alkyl, -C(=O)OR7, and cyclohexyl, wherein C1-C4 alkyl and -OCj-C3alkyl are optionally substituted with 1-2 groups independently selected from -N(R7)2, -C(O)OR7, and -OP(=O)(OR7)2-

In some embodiments, Z is selected from the group consisting of:

(a) -(CH2CH2θ -n Ci-C3alkyl, wherein C]-C3alkyl is optionally substituted with 1-2 substituent groups independently selected from phenyl, -C(-0)OR6, -OP(=0)(OR 7)2, and -P(=O)(OR 7)2, wherein phenyl is optionally substituted with one group -C(^O)OR 7; and

(b) phenyl, which is substituted with 1-3 substituents independently selected from C1-C4 alkyl, -OCi-C3alkyl, -C(=0)OR7, and cyclohexyl, wherein Ci-C4alkyl and -OCj-C3alkyl are optionally substituted with 1-2 groups independently selected from -N(R7)2, -C(=0)OR7, and -OP(=O)(OR7)2.

In some embodiments, R6 is selected from H, Ci~C2alkyl, and -CH2phenyl.

In some embodiments, R7 is selected from H and C1-C2alkyl.

A particularly preferred embodiment of this invention is directed to prodrugs for making the compound having formula III, including pharmaceutically acceptable salts thereof:
The prodrug that is converted to Compound III when it is administered to a patient has the formula IV, shown below, where X is as defined previously.

![Chemical Structure](image)

**Utility**

The prodrugs of Formula I and IV described above chemically eliminate the oxazolidinone-based drug under buffered conditions at a pH in the range of 7.0-8.0, and preferably at about 7.5, and at a temperature of about 37 °C (in the range of about 36-38 °C). These conditions are representative of the conditions that occur in the small intestine shortly after the contents of the stomach pass from the stomach into the small intestine. The drugs that are produced by the cyclization reactions, compounds II and III, are potent inhibitors of CETP in humans and animals, and have been shown to raise HDL-cholesterol and reduce LDL-cholesterol in humans and in animals that have CETP genes. The compounds are expected to have utility in the treatment and prevention of atherosclerosis and associated diseases and disorders.

The compounds and the formulations of the compounds are useful in treating diseases which are characterized by low-HDL and/or high-LDL, or which can be treated or ameliorated by raising HDL and/or reducing LDL such as hypercholesterolemia, hyperlipidemia, and atherosclerosis. Furthermore, administration of the compounds and formulations described herein does not cause an increase in blood pressure as was observed for torcetrapib.

Doses of the prodrug in humans that will be therapeutically effective in raising HDL and lowering LDL are the amounts that are equivalent after cyclization to active drug in an amount in the range of 20mg to 200mg, such as for example 20mg, 25 mg, 30 mg, 40mg, 50mg, 60mg, 70 mg, 80 mg, 90 mg, 100 mg, 110mg, 120mg, 130mg, 140mg, 150mg, 160mg, 180mg and 200mg, administered once or twice a day, but preferably once a day. A preferred dose will provide 100 mg of active drug and will be administered once a day.

The prodrugs provide improved bioavailability compared with conventional formulations of the active drug. Furthermore, conventional formulations comprising the CETP inhibitors that are made from the prodrugs herein exhibit a "food effect," which results in differences in the amount and rate of absorption into the body depending on when the patient was
last fed, how soon the patient eats after oral administration of the drug, and whether the patient
takes the drug before a meal, with a meal, or after a meal. The prodrug formulations disclosed
herein should exhibit a reduced food effect compared with conventional formulations because
they cyclize to the active drag after the prodrug has passed into the small intestine, which is the
site of absorption.

EXAMPLES

The following examples are provided to more fully illustrate the invention and are
not to be construed as limiting the scope of the invention, which is defined only by the appended
claims.

INTERMEDIATE 1

2,3,4-Trimethoxyphenol

A solution of 2,3,4-trimethoxybenzaldehyde (1.00 g, 5.10 mmol) and 30 wt/v %
hydrogen peroxide (0.672 mL, 6.52 mmol) in cone. H$_2$SO$_4$ (0.102 mL) and MeOH (10.19 mL)
was stirred overnight at 25 °C under N$_2$. After this time the mixture was diluted with water (20
mL) and extracted with CH$_2$Cl$_2$ (3 x 30 mL). The combined extracts were dried (MgSO$_4$) and
concentrated in vacuo to afford the crude product. This was purified by flash chromatography
(Biotage Horizon, 4OM, Si-30 niL/min, 100% hexanes for 360 mL, gradient to 50% EtOAc in
hexanes over 2088 mL) to afford 2,3,4-trimethoxyphenol, as a colorless oil. $R_f = 0.93 (50%$
EtOAc/hexanes). LCMS calc. = 185.1; found = 185.2 (M+H)$^+$. $^1$H NMR (600 MHz, CDCl$_3$): δ
6.62 (d, $J = 9.0$ Hz, 1 H); 6.55 (d, $J = 8.9$ Hz, 1 H); 5.49 (s, 1 H); 3.94 (s, 3 H); 3.89 (s, 3 H);
3.80 (s, 3 H).

The intermediates described in Table 1 were prepared using methods analogous to
those described for INTERMEDIATE 1 starting from commercially available benzaldehydes.

<table>
<thead>
<tr>
<th>Intermediate</th>
<th>Structure</th>
<th>LCMS (M+H)$^+$</th>
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**INTERMEDIATE 4**

**tert-Butyl (2^)-2-(tert-butoxycarbonyl)amino]-3-(4-hydroxyphenyl)propanoate**

A solution of di-tert-butyl dicarbonate (6.81 g, 31.2 mmol) in dry CH₂Cl₂ (15 mL) was added dropwise via cannula to a stirred solution of L-tyrosine tert-butyl ester (6.17 g, 26.0 mmol) and triethylamine (5.26 g, 7.25 mL, 52.0 mmol) at 0 °C under N₂. The reaction was stirred at room temperature overnight. Water (30 mL) was added and the mixture was stirred for 30 min. The organic layer was washed with water (20 mL), 0.05 M HCl (20 mL), water (20 mL) and brine (20 mL), dried (MgSO₄) and concentrated in vacuo to give the crude product. This was purified by flash chromatography (Biotage Horizon, 65i, Si, ~70 mL/min, 100% hexanes for 450 mL, gradient to 25% EtOAc in hexanes over 4446 mL, gradient to 40% EtOAc in hexanes over 2448 mL) to afford tert-butyl (2^)-2-[(tert-butoxycarbonyl)amino]-3-(4-hydroxyphenyl)propanoate. Rf = 0.28 (20% EtOAc/hexanes). LCMS calc. = 360.2; found = 359.9 (M+Na)⁺. ¹H NMR (500 MHz, CDCl₃): δ 7.02 (d, J = 8.1 Hz, 2 H); 6.73 (d, J = 8.1 Hz, 2 H); 5.41 (s, 1 H); 4.99 (d, J = 7.9 Hz, 1 H); 4.40 (q, J = 6.6 Hz, 1 H); 3.01-2.93 (m, 2 H); 1.42 (s, 9 H); 1.41 (s, 9 H).

**INTERMEDIATE 5**
**tert-Butyl 2-[(tert-butoxycarbonylamino)-3-(4-hydroxy-3-methoxyphenyl)propanoate**

**Step A:** 2-[(tert-butoxycarbonylamino)-3-(4-hydroxy-3-methoxyphenyl)propanoic acid

Triethylamine (719 mg, 980 µL, 7.10 mmol) was added to a solution of 3-methoxy-DL-tyrosine (1.00 g, 4.73 mmol) in 1,4-dioxane/water (1:1, 17.2 mL). The solution was cooled to 0 °C and di-tert-butyl dicarbonate (1.14 g, 5.21 mmol) was added in one batch. The reaction was warmed to room temperature and stirred for 3 days. The reaction mixture was concentrated *in vacuo* and the residue was diluted with water and EtOAc. The aqueous layer was washed with EtOAc, acidified to pH 1 with IN HCl and back extracted with EtOAc. The combined organic extracts were dried (MgSO₄) and concentrated *in vacuo* to afford 2-[(tert-butoxycarbonylamino)-3-(4-hydroxy-3-methoxyphenyl)propanoic acid, as an off-white solid. LCMS calc. = 334.1; found = 333.8 (M+Na)+. 

1H NMR (500 MHz, CDCl₃): δ 6.77-6.67 (m, 3 H); 5.28 (d, J = 7.2 Hz, 1 H); 4.39 (dd, J = 5.8, 12.4 Hz, 1 H); 3.83 (s, 3 H); 3.12 (dd, J = 5.3, 13.8 Hz, 2 H); 1.41 (s, 9 H); 1.35 (s, 1 H).

**Step B:** /erf-Butyl 2-(tert-butoxycarbonylamino)-3-(4-hydroxy-3-methoxyphenyl)propanoate

/-BuOH (5.17 g, 6.67 mL, 69.8 mmol) was added to a stirred suspension of 2-[(fert-butoxycarbonylamino)-3-(4-hydroxy-3-methoxyphenyl)propanoic acid (1.55 g, 4.98 mmol) in dry toluene (25 mL). The mixture was brought to reflux to give a homogeneous solution. The mixture was brought to reflux to give a homogeneous solution. After heating at reflux to 3-4 h, the reaction mixture was cooled to room temperature and a saturated solution of NaHCO₃ (40 mL) was added. The mixture was extracted with CH₂Cl₂ (3 × 40 mL) and the combined extracts were dried (Na₂SO₄) and concentrated *in vacuo* to give the crude product. This was purified by flash chromatography (Biotage Horizon, 40M, Si, -30 mL/min, 100% hexanes for 360 mL, gradient to 20% EtOAc in hexanes over 4536 mL) to afford (tert-butoxycarbonylamino)-3-(4-hydroxy-3-methoxyphenyl)propanoate. Rₚ = 0.42 (20% EtOAc/hexanes). LCMS calc. = 390.2; found = 389.9 (M+Na)+. 

1H NMR (500 MHz, CDCl₃): δ 6.82 (d, J = 7.9 Hz, 1 H); 6.87-6.63 (m, 2 H); 5.54 (s, 1 H); 4.97 (d, J = 7.8 Hz, 1 H); 4.40 (q, J = 6.7 Hz, 1 H); 3.86 (s, 3 H); 2.98 (d, J = 6.0 Hz, 2 H); 1.42 (s, 9 H); 1.41 (s, 9 H).
Potassium hydroxide (368.3 mg, 6.56 mmol) was added to a stirred solution of (4S,5R)-5-[3,5-bis(trifluoromethyl)phenyl]-3-[[4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifluoromethyl)biphenyl-2-yl]methyl]-4-methyl-1,3-oxazolidin-2-one (0.87 g, 1.36 mmol) in i-PrOH (44.7 mL) and water (9.0 mL) and the mixture was heated at 75 °C in a sealed tube overnight. The reaction was cooled to room temperature and concentrated in vacuo to remove most of the i-PrOH. Brine (25 mL) was added and the mixture was extracted with EtOAc (3 x 50 mL). The combined extracts were dried (MgSO₄) and concentrated in vacuo to afford (1'R²S) 1-[3,5-bis(trifluoromethyl)phenyl]-2-[[4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifluoromethyl)biphenyl-2-yl]methyl]amino)propan-1-ol, as a colorless solid. Rf = 0.49 (20% EtOAc/hexanes). LCMS calc. = 612.2; found = 611.8 (M+H)⁺. ¹H NMR (500 MHz, CDCl₃): δ 7.76-7.69 (m, 4 H); 7.60 (d, J = 7.8 Hz, 1 H); 7.33 (dd, J = 4.0, 7.9 Hz, 1 H); 7.00 (d, J = 8.5 Hz, 1 H); 6.71 (dd, J = 5.9, 11.9 Hz, 1 H); 4.74 (br d, J = 16.0 Hz, 1 H); 3.85-3.70 (m, 5 H); 3.26-3.18 (m, 1 H); 2.81-2.78 (m, 1 H); 1.28-1.20 (m, 7 H); 0.62 (d, J = 6.5 Hz, 3 H).
**tert-Butyl Ul5.2igV2-r3.5-bisflriflttorome1fa γ l)phenvI1-2 -hy άroxv-l-me1fa γ lethvU ( f4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifluoromethyl)biphenyl-2-yl)methyl}amino)propan-l-ol**

Disopropylethylamine (363 mg, 489 µL, 2.81 mmol) was added to a stirred solution of (R,2S)-1-[3,5-bis(trifluoromethyl)phenyl]-2-\{[4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifluoromethyl)biphenyl-2-yl]methyl\}amino)propan-l-ol (858 mg, 1.40 mmol) in dry MeCN (16 mL) at room temperature under N₂. The resulting solution was cooled to 0°C and di-tert-butyl dicarbonate (337 mg, 1.54 mmol) was added. The resulting mixture was warmed to room temperature and stirred for 2 days. The reaction mixture was diluted with Et₂O (20 mL) and washed with water (10 mL) and brine (10 mL), dried (MgSO₄) and concentrated in vacuo to give the crude product. This was purified by flash chromatography (Biotage Horizon, 25M, Si, -20 mL/min, 100% hexanes for 144 mL, gradient to 20% EtOAc in hexanes over 2880 mL) to afford tert-butyl \{(15,2j?)-2-[3,5-bis(trifluoromethyl)phenyl]-2-hydroxy-1-methylethyl\} \{[4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifluoromethyl)biphenyl-2-yl]methyl\}carbamate, as a colorless solid. R' = 0.63 (20% EtOAc/hexanes). LCMS calc. = 734.2; found = 733.9 (M+Na)⁺.

**INTERMEDIATE 8**

![Diagram of Intermediate 8](image)

**Dibenzyl 2-(4-hydroxyphenyl)ethyl phosphate**

**Step A: 4-(2-Bromoethyl)phenyl acetate**

Acetyl chloride (2.01 g, 1.82 mL, 25.6 mmol) was added to a stirred solution of pyridine (2.02 g, 2.07 mL, 25.6 mmol) and 4-hydroxyphenethyl bromide (856.5 mg, 4.26 mmol) in dry CH₂Cl₂ (17 mL) and the reaction was stirred at room temperature for 2 h. The reaction mixture was diluted with water (20 mL) and extracted with CH₂Cl₂ (2 x 40 mL). The combined extracts were dried (MgSO₄) and concentrated in vacuo to afford 4-(2-bromoethyl)phenyl acetate. 'H NMR (500 MHz, CDCl₃): δ 7.22 (d, J = 8.3 Hz, 2 H); 7.04 (d, J = 8.3 Hz, 2 H); 3.55 (t, J = 7.6 Hz, 2 H); 3.16 (t, J = 7.6 Hz, 2 H); 2.29 (s, 3 H).

**Step B: 4-f2-{[Bis(benzylox γ)phosphoryl]oxy}ethyl]phenyl acetate**

Silver dibenzylphosphate (2.08 g, 5.39 mmol) was added to a stirred solution of 4-(2-bromoethyl)phenyl acetate (1.31 g, 5.39 mmol) in toluene (43 mL) and the mixture was heated at reflux overnight. The precipitate formed was removed by filtration through a plug of Celite.

The filter cake was washed with toluene and the combined filtrates were concentrated in vacuo to
give the crude product. This was purified by flash chromatography (Biotage Horizon, 4OM, Si, -30 mL/min, 100% hexanes for 360 mL, gradient to 50% EtOAc in hexanes over 4536 mL) to afford 4-(2-[[bis(benzyloxy)phosphoryl]oxy]ethyl)phenyl acetate. Rf = 0.51 (50% EtOAc/hexanes). LCMS calc. = 441.1; found = 440.9 (M+H)+. 1H NMR (500 MHz, CHCl3): δ 7.37-7.30 (m, 10 H); 7.15 (d, J = 8.3 Hz, 2 H); 6.99 (d, J = 8.3 Hz, 2 H); 4.15 (q, J = 7.1 Hz, 2 H); 2.89 (t, J = 7.0 Hz, 2 H); 2.28 (s, 3 H).

Step C: Dibenzyl 2-(4-hydroxyphenyl)ethyl phosphate

Potassium carbonate (62.8 mg, 0.454 mmol) was added to a stirred solution of 4- (2-[[bis(benzyloxy)phosphoryl]oxy]ethyl)phenyl acetate (100 mg, 0.227 mmol) in MeOH (20.5 mL) at 25 °C. The reaction was stirred at 25 °C for 1 h. The reaction mixture was concentrated in vacuo and the resulting residue was partitioned between water (20 mL) and EtOAc (20 mL). The aqueous layer was separated and extracted with EtOAc (2 x 20 mL). The combined organic extracts were dried (MgSO4) and concentrated in vacuo to afford dibenzyl 2-(4-hydroxyphenyl)ethyl phosphate, as an oil. LCMS calc. = 399.1; found = 398.9 (M+H)+. 1H NMR (500 MHz, CHCl3): δ 8.05 (1 H, s); 7.41-7.30 (m, 10 H); 6.99 (d, J = 8.2 Hz, 2 H); 6.86 (d, J = 8.3 Hz, 2 H); 5.02 (s, 2 H); 5.00 (s, 2 H); 4.18 (q, J = 7.1 Hz, 2 H); 2.86 (t, J = 7.1 Hz, 2 H).

INTERMEDIATE 9

Dibenzyl 2-(4-hydroxy-3-methoxyphenox y)ethyl phosphate

Step A: 4-(2-Hydroxyethoxy)-2’-methoxybenzaldehyde

A solution of 4-hydroxy-2-methoxybenzaldehyde (1.217 g, 8.00 mmol) in dry DMF (8.88 mL) was added to a stirred suspension of sodium hydride (60% dispersion in mineral oil) (0.267 mL, 8.00 mmol) in dry DMF (2.22 mL) via cannula at 0 °C under N2. The reaction mixture was stirred at 0 °C for 30 min and warmed to room temperature. 2-bromoethanol (0.85 mL, 12.00 mmol) was added dropwise and the reaction mixture was stirred at 50 °C overnight. The reaction was diluted with water (50 mL) and extracted with EtOAc (3 x 50 mL). The combined extracts were washed with IN aq. NaOH (50 mL), dried (MgSO4) and concentrated in vacuo to afford the crude product. This was purified by Dash chromatography (Biotage Horizon,
4OM, Si, -30 mL/min, 100% hexanes for 360 mL, gradient to 60% EtOAc in hexanes over 4536 mL) to afford 4-(2-hydroxyethoxy)-2-methoxybenzaldehyde, as a colorless solid. R' = 0.29 (50% EtOAc/hexanes). LCMS calc. = 197.1; found = 197.0 (M+H)+. 1H NMR (500 MHz, CHCl₃): δ 10.16 (s, 1 H); 7.68 (d, J = 8.7 Hz, 1 H); 6.46 (dd, J = 8.7, 2.2 Hz, 1 H); 6.40 (d, J = 2.2 Hz, 1 H); 4.09 (t, J = 4.6 Hz, 2 H); 3.94 (t, J = 4.4 Hz, 2 H); 3.79 (s, 3 H); 3.20 (s, 1 H).

Step B: 4-(2-Hydroxyethoxy)-2-methoxyphenol

A solution of 4-(2-hydroxyethoxy)-2-methoxybenzaldehyde (465.6 mg, 2.373 mmol) and 30 wt% hydrogen peroxide (0.313 mL, 3.04 mmol) in cone. H₂SO₄ (0.0475 mL) and MeOH (4.75 mL) was stirred overnight at 25 °C under N₂. After this time the mixture was diluted with water (20 mL) and extracted with CH₂Cl₂ (3 x 30 mL). The combined extracts were dried (MgSO₄) and concentrated in vacuo to afford the crude product. This was purified by flash chromatography (Biotage Horizon, 25M₅, Si, ~20 mL/min, 100% hexanes for 144 mL, gradient to 55% EtOAc in hexanes over 2394 mL, gradient to 100% EtOAc over 999 mL) to afford 4-(2-hydroxyethoxy)-2-methoxyphenol, as a colorless oil. R' = 0.30 (50% EtOAc/hexanes). LCMS calc. = 207.1; found = 206.9 (M+Na)+. 1H NMR (500 MHz, CHCl₃): δ 6.77 (d, J = 8.6 Hz, 1 H); 6.47 (d, J = 2.8 Hz, 1 H); 6.34 (dd, J = 8.7, 2.8 Hz, 1 H); 5.82 (s, 1 H); 3.98 (t, J = 4.6 Hz, 2 H); 3.90 (t, J = 4.5 Hz, 2 H); 3.76 (s, 3 H); 2.96 (s, 1 H).

Step C: 4-(2-Hydroxyethoxy)-2-methoxyphenyl acetate

A solution of 1-acetyl-1H-1,2,3-triazolo[4,5-b]pyridine (0.248 g, 1.532 mmol) in dry THF (6.13 mL) was added to a solution of 4-(2-hydroxyethoxy)-2-methoxyphenol (0.2821 g, 1.532 mmol) in 1N aq. NaOH (1.532 mL, 1.532 mmol) at 25 °C. The reaction was stirred at 25 °C for 3 h. The reaction was diluted with IN HCl (20 mL) and extracted with Et₂O (3 x 20 mL). The combined extracts were dried (MgSO₄) and concentrated in vacuo to afford the crude product. This was purified by flash chromatography (Biotage Horizon, 25M, Si, -20 mL/min, 100% hexanes for 144 mL, gradient to 50% EtOAc in hexanes over 360 mL, gradient to 100% EtOAc over 2034 mL) to afford 4-(2-hydroxyethoxy)-2-methoxyphenyl acetate. R' = 0.28 (50% EtOAc/hexanes). LCMS calc. = 249.1; found = 249.0 (M+Na)+. 1H NMR (500 MHz, CHCl₃): δ 6.87 (d, J = 8.7 Hz, 1 H); 6.52 (d, J = 2.7 Hz, 1 H); 6.38 (dd, J = 8.7, 2.7 Hz, 1 H); 3.96 (t, J = 4.7 Hz, 2 H); 3.84 (t, J = 4.7 Hz, 2 H); 3.71 (s, 3 H); 2.97 (s, 1 H); 2.24 (s, 3 H).

Step D: 4-(2-Bromoethoxy)-2-methoxyphenyl acetate

A solution of triphenylphosphine (0.123 mL, 0.530 mmol) in dry CH₂Cl₂ (1.3 mL) was added dropwise via cannula to a stirred solution of 4-(2-hydroxyethoxy)-2-methoxyphenyl acetate (100 mg, 0.442 mmol) and carbon tetrabromide (0.051 mL, 0.530 mmol) in dry CH₂Cl₂ (3.0 mL) at 0 °C under N₂. After 5 h at 0 °C, the reaction mixture was concentrated in vacuo and...
the residue obtained was purified by flash chromatography (Biotage Horizon, 25M, Si, ~20
nL/min, 100% hexanes for 144 mL, gradient to 50% EtOAc in hexanes over 1125 mL) to afford
4-(2-bromoethoxy)-2-methoxyphenyl acetate, as a colorless oil. \( R^* = 0.78 \) (50%
EtOAc/hexanes). LCMS calc. = 289.1; found = 288.8 (M+H)+. \(^1\)H NMR (500 MHz, CHCl\(_3\)): \( \delta 
6.93 \) (d, \( J = 8.7 \) Hz, 1 H); \( 6.57 \) (d, \( J = 2.8 \) Hz, 1 H); \( 6.42 \) (dd, \( J = 8.7, 2.8 \) Hz, 1 H); \( 4.26 \) (t, \( J = 
6.2 \) Hz, 2 H); \( 3.80 \) (s, 3 H); \( 3.62 \) (t, \( J = 6.2 \) Hz, 2 H); \( 2.29 \) (s, 3 H).

Step E: 4-(2-[[Bis(benzylloxy)phosphoryl]oxy]ethoxy)-2-methoxyphenylacetate

Silver dibenzylphosphate (134 mg, 0.348 mmol) was added to a solution of 4-(2-
bromoethoxy)-2-methoxyphenyl acetate (100.6 mg, 0.348 mmol) in toluene (2.762 mL) and the
mixture was heated at reflux overnight. The precipitate formed was removed by filtration
through a plug of Celite and washed through with toluene. The filtrate was concentrated \textit{in vacuo}
to give the crude product. This was purified by flash chromatography (Biotage Horizon, 20M, Si~20 mL/min, 100% hexanes for 144 mL, gradient to 70% EtOAc in hexanes over 1125
mL, gradient to 100% EtOAc over 999 mL) to afford 4-(2-
[[bis(benzylloxy)phosphoryl]oxy]ethoxy)-2-methoxyphenyl acetate, as a colorless oil. \( R^* = 0.26 
(50%\text{ EtOAc/hexanes}). \) LCMS calc. = 487.2; found = 486.9 (M+H)+. \(^1\)H NMR (500 MHz,
CHCl\(_3\)): \( \delta 
7.35-7.31 \) (m, 10 H); \( 6.91 \) (d, \( J = 8.7 \) Hz, 1 H); \( 6.50 \) (d, \( J = 2.7 \) Hz, 1 H); \( 6.37 \) (dd, \( J 
= 8.7, 2.7 \) Hz, 1 H); \( 5.12-5.02 \) (m, 4 H); \( 4.33-4.28 \) (m, 2 H); \( 4.07 \) (t, \( J = 4.6 \) Hz, 2 H); \( 3.73 \) (s, 3
H); \( 2.28 \) (s, 3 H).

Step F: Dibenzy 2-(4-hydroxy-3-methoxyphenoxy)ethylphosphate

Potassium carbonate (0.072 g, 0.524 mmol) was added to a stirred solution of 4-
(2-[[bis(benzylloxy)phosphoryl]oxy]ethoxy)-2-methoxy phenyl acetate (0.1274 g, 0.262 mmol) in
MeOH (17.5 mL) at 25 °C. The reaction was stirred at 25 °C for 1 h. The reaction mixture was
concentrated \textit{in vacuo} and the resulting residue was partitioned between water (20 mL) and
EtOAc (20 mL). The aqueous layer was separated and extracted with EtOAc (2 x 20 mL). The
combined organic extracts were dried (MgSO\(_4\)) and concentrated \textit{in vacuo} to afford dibenzyl 2-
(4-hydroxy-3-methoxyphenoxy)ethyl phosphate, as an oil. LCMS calc. = 445.1; found = 444.9
(M+H)+.
Methyl 5-f3-[(bis(benzyloxy)phosphoryl)oxy]propyl)-2-hydroxy-3-methylbenzoate

**Step A: Methyl 2-hydroxy-5-iodo-3-methylbenzoate**

Methyl 2-hydroxy-3-methylbenzoate (0.869 g, 5.23 mmol) in MeOH (5 ml) was added dropwise to a suspension of iodine (1.327 g, 5.23 mmol) and silver sulfate (1.63 g, 5.23 mmol), at room temperature under N₂. The resultant brown suspension was stirred for 3 h after which time a colorless suspension was observed. The mixture was filtered through a plug of Celite, washed with MeOH (30 ml) and concentrated in vacuo to afford methyl 2-hydroxy-5-iodo-3-methylbenzoate, as a colorless solid. LCMS calc. = 292.1; found = 292.7 (M+H)⁺. ¹H NMR (500 MHz, CDCl₃): δ 11.0 (s, 1 H); 8.02 (s, 1 H); 7.62 (s, 1 H); 3.97 (s, 3 H); 2.25 (s, 3 H).

**Step B: Methyl 2-(acetyloxy)-5-iodo-3-methylbenzoate**

To a stirred suspension of 2-hydroxy-5-iodo-3-methylbenzoate (1.24 g, 4.25 mmol) in neat acetic anhydride (1.803 mL, 19.10 mmol) was added a drop of concentrated sulfuric acid (0.226 mL, 4.25 mmol). The resultant orange solution was stirred at room temperature overnight. The solution was diluted with 3% aqueous NaHCO₃ (13 mL) and extracted with CHCl₃ (3 x 30 mL). The combined organic phases were washed with water (4 x 20 mL), dried (MgSO₄), and concentrated in vacuo to afford methyl 2-(acetyloxy)-5-iodo-3-methylbenzoate, as a colorless solid. ¹H NMR (500 MHz, CDCl₃): δ 8.17 (s, 1 H); 7.78 (s, 1 H); 3.89 (s, 3 H); 2.25 (s, 3 H); 2.21 (s, 3 H).

**Step C: Methyl 2-(acetyloxy)-5-(3-hydroxyprop-1-ynyl)-3-methylbenzoate**

Triethylamine (0.943 mL, 6.76 mmol) and bis(triphenylphosphine)palladium(II) chloride (0.092 g, 0.132 mmol) were added to a mixture of methyl 2-(acetyloxy)-5-iodo-3-methylbenzoate (1.0 g, 2.99 mmol) and propargyl alcohol (0.161 mL, 2.69 mmol) in THF (20 mL) at room temperature, and then copper (I) iodide (0.053 g, 0.278 mmol) was added. The resulting mixture was stirred at room temperature for 18 h. The reaction was quenched with water (20 mL) and extracted with EtOAc (3 x 30 mL). The combined organic extracts were washed with water (50 mL), brine (40 mL), dried (MgSO₄), and concentrated in vacuo to give the crude product. This was purified by flash chromatography (Si, 0-20% EtOAc in hexanes over 30 min) to afford methyl 2-(acetyloxy)-5-(3-hydroxyprop-1-ynyl)-3-methylbenzoate, as a yellow
solid. \textsuperscript{1}H NMR (500 MHz, CHCl\textsubscript{3}): \(\delta\) 7.97 (s, 1 H); 7.53 (s, 1 H); 4.91 (s, 2 H); 3.88 (s, 3 H); 2.22 (s, 3 H); 2.16 (s, 3 H).

**Step D:** Methyl 2-(acetoxy)-5-[(1\textsuperscript{z}-3-hydroxyprop-1-en-1-yl)]-3-methylbenzoate

A suspension of methyl 2-(acetoxy)-5-(3-hydroxyprop-1-yn-1-yl)-3-methylbenzoate (0.417 g, 1.590 mmol) and palladium on carbon (170 mg, 1.597 mmol) in EtOAc (20 mL) was stirred at room temperature under a balloon atmosphere of H\textsubscript{2} for 3 days. The reaction mixture was filtered through a plug of Celite and washed through with EtOAc (3×30 mL). The filtrate was concentrated in vacuo to give the crude product. This was purified by flash chromatography (Si, 0-20% EtOAc in hexanes over 40 min) to afford methyl 2-(acetoxy)-5-[(1\textsuperscript{z}-3-hydroxyprop-1-en-1-yl)]-3-methylbenzoate, as a pale yellow oil. \textsuperscript{1}H NMR (500 MHz, CHCl\textsubscript{3}): \(\delta\) 7.69 (s, 1 H); 7.29 (s, 1 H); 6.53 (d, \(J = 12\) Hz, 1 H); 5.94 (m, 1 H); 4.44 (d, \(J = 6.4\) Hz, 2 H); 3.88 (s, 3 H); 2.40 (s, 3 H); 2.25 (s, 3 H).

**Step E:** Methyl 2-facetoxy)-5-(3-hydroxypropyl)-3-methylbenzoate

A suspension of 10\% palladium on carbon (146 mg, 0.137 mmol) in a solution of methyl 2-(acetoxy)-5-[(1\textsuperscript{z}-3-hydroxyprop-1-en-1-yl)]-3-methylbenzoate (362 mg, 1.370 mmol) in EtOAc (17.2 mL) was shaken in a Parr shaker under H\textsubscript{2} at 40 psi overnight. The reaction mixture was filtered through a plug of Celite and washed through with EtOAc. The filtrate was concentrated in vacuo to afford the crude product. This was purified by flash chromatography (Biotage Horizon, 25M, Si, ~20 mL/min, 100\% hexanes for 144 mL, gradient to 60\% EtOAc in hexanes over 1125 mL) to afford methyl 2-(acetoxy)-5-(3-hydroxypropyl)-3-methylbenzoate, as a colorless oil. LCMS calc. = 289.1; found = 288.9 (M+Na). \textsuperscript{1}H NMR (500 MHz, CHCl\textsubscript{3}): \(\delta\) 7.65 (d, \(J = 2.2\) Hz, 1 H); 7.25 (d, \(J = 2.2\) Hz, 1 H); 3.84 (s, 3 H); 3.64 (t, \(J = 6.4\) Hz, 2 H); 2.67 (t, \(J = 7.8\) Hz, 2 H); 2.35 (s, 3 H); 2.18 (s, 3 H); 1.89-1.82 (m, 2 H).

**Step F:** Methyl 2-(acetoxy)-5-(3-[[bis(benzyl|oxy)phosphoryl|oxy]propyl)-3-methylbenzoate

Dibenzyl N,N-diisopropylphosphoramidite (0.252 mL, 0.751 mmol) was added to a stirred solution of 1H-tetrazole (3 wt\% in CH\textsubscript{3}CN) (4.40 mL, 1.502 mmol) and methyl 2-(acetoxy)-5-(3-hydroxypropyl)-3-methylbenzoate (100 mg, 0.376 mmol) in dry CH\textsubscript{2}Cl\textsubscript{2} (4.50 mL) at 25 \(^{\circ}\)C under N\textsubscript{2}. The reaction was stirred for 2 h at 25 \(^{\circ}\)C. After this time another 0.5 eq dibenzyl N,N-diisopropylphosphoramidite was added and the reaction was stirred for 30 min. The reaction mixture was cooled to 0 \(^{\circ}\)C and a solution of 3-chloroperoxybenzoic acid (337 mg, 1.502 mmol) in dry CH\textsubscript{2}Cl\textsubscript{2} (3.00 mL) was added via cannula. After 30 min another 1 eq 3-chloroperoxybenzoic acid was added and the reaction was stirred at 0 \(^{\circ}\)C. After 30 min the reaction was diluted with EtOAc (30 mL) and washed with successive portions of saturated Na\textsubscript{2}SO\textsubscript{3} (20 mL) and saturated NaHCO\textsubscript{3} (20 mL), dried (MgSO\textsubscript{4}) and concentrated in vacuo to
give the crude product. This was purified by flash chromatography (Biotage Horizon, 25M, Si, ~20 nL/min, 100% hexanes for 144 mL, gradient to 60% EtOAc in hexanes over 2394 mL) to afford methyl 2-(acetyloxy)-5-(3-{{bis(benzyloxy)phosphoryl}oxy}propyl)-3-methylbenzoate, as a colorless oil. LCMS calc. = 527.2; found = 527.0 (M+H)+. 1H NMR (500 MHz, CDCl3): δ 7.62 (d, J = 2.2 Hz, 1 H); 7.36-7.31 (m, 10 H); 7.18 (d, J = 2.2 Hz, 1 H); 5.1-4.98 (m, 4 H); 4.00 (q, J = 6.6 Hz, 2 H); 3.84 (s, 3 H); 2.61 (t, J = 7.8 Hz, 2 H); 2.36 (s, 3 H); 2.17 (s, 3 H); 1.93-1.85 (m, 2 H).

**Step G:** Methyl 5-(3-{{bis(benzyloxy)phosphoryl}oxy}propyl)-2-hydroxy-3-methylbenzoate

K2CO3 (108 mg, 0.784 mmol) was added to a stirred solution of methyl 2-(acetyloxy)-5-(3-{{bis(benzyloxy)phosphoryl}oxy}propyl)-3-methylbenzoate (206.3 mg, 0.392 mmol) in MeOH (26.1 mL) at 25 °C. The reaction was stirred at 25 °C for 1 h. The reaction mixture was concentrated in vacuo and the resulting residue was partitioned between water (20 mL) and EtOAc (20 mL). The aqueous layer was separated and extracted with EtOAc (2 x 20 mL). The combined organic extracts were dried (MgSO4) and concentrated in vacuo to afford methyl 5-(3-{{bis(benzyloxy)phosphoryl}oxy}propyl)-2-hydroxy-3-methylbenzoate, as a colorless oil. LCMS calc. = 485.2; found = 485.0 (M+H)+.

**INTERMEDIATE 11**

![Dibenzyl 2-hydroxyethyl phosphate](image)

**Dibenzyl 2-hydroxyethyl phosphate**

To a stirred solution of 2-bromoethanol (200 mg, 1.600 mmol) in anhydrous toluene (15 mL) was added silver dibenzylphosphate (616 mg, 1.600 mmol) and the resultant mixture was heated at reflux for 4 h. The reaction mixture was filtered through Celite, and washed through with additional toluene (2 x 25 mL). The combined organic extracts were concentrated in vacuo and the resulting crude product purified by flash chromatography (75% EtOAc/hexanes) to afford dibenzyl 2-hydroxyethyl phosphate, as a colorless oil.

**INTERMEDIATE 12**
Dibenzyi 2-(4-hydroxy-3-isopropoxyphenoxy)ethyl phosphate

Step A: 4-(Benzyloxy)-2-isopropoxybenzaldehyde

K$_2$CO$_3$ (9.62 g, 69.6 mmol) and 2-iodopropane (2.00 mL, 20.00 mmol) were added successively to a stirred solution of 4-benzyloxy-2-hydroxybenzaldehyde (3.65 g, 16.0 mmol) in dry DMF (20.0 mL) at 25 °C under N$_2$. The reaction was heated at 50 °C overnight. The reaction was diluted with water (50 mL) and extracted with EtO (3 x 50 mL). The combined extracts were dried (MgSO$_4$) and concentrated in vacuo to afford 4-(benzyloxy)-2-isopropoxybenzaldehyde. LCMS calc. = 293.1; found = 292.9 (M+Na)$^+$.  

Step B: 4-Hydroxy-2-isopropoxybenzaldehyde

A suspension of 10% palladium on carbon (0.793 g, 0.745 mmol) in a solution of 4-(benzyloxy)-2-isopropoxybenzaldehyde (4.03 g, 14.91 mmol) and 1-methyl-1,4-cyclohexadiene (16.75 mL, 149 mmol) in EtOH (298 mL) was heated at reflux for 2 h. The reaction mixture was cooled to room temperature, filtered through a plug of Celite and washed through with EtOAc. The filtrate was concentrated in vacuo to afford 4-hydroxy-2-isopropoxybenzaldehyde, as a colorless solid. LCMS calc. = 181.1; found = 181.0 (M+H)$^+$. $^1$H NMR (500 MHz, CHCl$_3$): $\delta$ 10.12 (s, 1H); 7.74 (d, $J = 8.6$ Hz, 1H); 6.52 (dd, $J = 8.7, 2.1$ Hz, 1H); 6.47 (d, $J = 2.1$ Hz, 1H); 4.62-4.54 (m, 1H); 1.36 (d, $J = 6.1$ Hz, 6 H).

4-Hydroxy-2-isopropoxybenzaldehyde was used to synthesize dibenzyi 2-(4-hydroxy-3-isopropoxyphenoxy)ethyl phosphate using methods analogous to those described in INTERMEDIATE 9 and 10 above.

INTERMEDIATE 13

Dibenzyi (3-hydroxypropylphosphonate

Dibenzyl phosphite (1.70 mL, 7.63 mmol) was added to a stirred suspension of sodium hydride (60% dispersion in mineral oil) (0.381 g, 9.53 mmol) in dry DMF (11.4 mL) at 25 °C under N₂. After 15 min 2-(3-bromopropoxy)tetrahydro-2//-pyran (1.29 mL, 7.63 mmol) was added and the mixture was stirred at 25 °C for 5 h. The reaction mixture was diluted with CH₂Cl₂ (50 mL) and washed with water (20 mL) and extracted with Et₂O (2 x 40 mL). The combined organic extracts were washed with brine (20 mL), dried (Na₂SO₄) and concentrated *in vacuo* to afford dibenzyl [3-(tetrahydro-2//-pyran-2-yloxy)propyl]phosphonate. R' = 0.06 (20% EtOAc/hexanes). LCMS calc. = 427.17; found = 427.15 (M+Naf).

Step B: Dibenzyl (3-hydroxypropyl)phosphonate

A solution of dibenzyl [3-(tetrahydro-2//-pyran-2-yloxy)propyl]phosphonate (3.08 g, 7.62 mmol) and pyridinium p-toluenesulfonate (0.191 g, 0.762 mmol) in EtOH (76 mL) was stirred at 55 °C overnight. The reaction mixture was cooled to room temperature and concentrated *in vacuo* to give the crude product. This was purified by flash chromatography (Biotage Horizon, 4OM, Si, ~30 mL/min, 100% hexanes for 360 mL, gradient to 100% EtOAc in hexanes over 3096 mL, 100% EtOAc for 3888 mL) to afford dibenzyl (3-hydroxypropyl)phosphonate. R' = 0.34 (EtOAc). LCMS calc. = 321.13; found = 321.04 (M+H)+. ¹H NMR (500 MHz, CHCl₃): δ 7.35-7.28 (m, 10 H); 5.02 (dd, J = 11.9, 8.9 Hz, 2 H); 4.94 (dd, J = 11.9, 8.0 Hz, 2 H); 3.60 (t, J = 5.6 Hz, 2 H); 3.37 (s, 1 H); 1.90-1.75 (m, 4 H).

**Intermediate**

![Intermediate Structure](image)

**Tetrabenzyl 2-(2-hydroxyethoxy)propane-1, 3-diyl bisphosphate**

Step A: 2-Phenyl-5-[2-(tetrahydro-2//-pyran-2-yloxy )ethoxy]-1 ,3-dioxane

Sodium hydride (60% disp. in mineral oil) (0.666 g, 16.65 mmol) was added to a stirred solution of 1,3-benzylidene glycerol (1.00 g, 5.55 mmol) in dry DMF (13.9 mL). The reaction mixture was stirred at room temperature for 1 h. 2-(2-bromoethoxy)tetrahydro-2//-pyran (1.26 mL, 8.32 mmol) was added dropwise and the reaction mixture was stirred at room temperature overnight. The reaction was diluted with CH₂Cl₂ (50 mL) and washed with water.
(50 mL). The aqueous layer was washed with CH₂Cl₂ (25 mL). The combined organic layers were washed with brine (50 mL), dried (MgSO₄) and concentrated in vacuo to give the crude product. This was purified by flash chromatography (Biotage Horizon, 40M, Si, 30 mL/min, 100% hexanes for 360 mL, gradient to 50% EtOAc in hexanes over 4536 mL) to afford 2-phenyl-5-{2-(tetrahydro-2H-pyran-2-yloxy)ethoxy]-1,3-dioxane, as a colorless oil. \( R^f = 0.54 \) (50% EtOAc/hexanes). LCMS calc. = 657.20; found = 657.06 (M+H)⁺.


A suspension of 10% palladium on carbon (172 mg, 0.162 mmol) in a solution of 2-phenyl-5-{2-(tetrahydro-2H-pyran-2-yloxy)ethoxy]-1,3-dioxane (498.9 mg, 1.618 mmol) in EtOAc (32.4 mL) was stirred under H₂ at 25 °C for 3 days. The reaction mixture was filtered through a plug of Celite and the filtrate was concentrated in vacuo to afford 2-[2-(tetrahydro-2H-pyran-2-yloxy)ethoxy]propane-1,3-diol. LCMS calc. = 243.12; found = 243.22 (M+Na)⁺.

**Step C**: Tetrabenzy1 2-[2-(tetrahydro-2H-pyran-2-yloxy)ethoxy]propane-1,3-diylbis(phosphate)

Dibenzy1 N,N-diisopropylphosphoramidite (1.43 mL, 4.26 mmol) was added to a stirred solution of tlt-tetrazole (0.45 M in CH₃CN) (18.9 mL, 8.52 mmol) and 2-[2-(tetrahydro-2H-pyran-2-yloxy)ethoxy] propane-1,3-diol (312.6 mg, 1.419 mmol) in dry CH₂Cl₂ (17.0 mL) at 25 °C under N₂. The reaction was stirred for 2 h at 25 °C. The reaction mixture was cooled to 0 °C and a solution of 3-chloroperoxybenzoic acid (1272 mg, 5.68 mmol) in dry CH₂Cl₂ (11.4 mL) was added via cannula and the reaction was stirred at 0 °C. After 60 min the reaction was diluted with EtOAc (50 mL) and washed with successive portions of saturated Na₂SO₃ (50 mL) and saturated NaHCO₃ (50 mL), dried (Na₂SO₄) and concentrated in vacuo to afford the crude product. This was purified by flash chromatography (Biotage Horizon, 40M, Si, 30 mL/min, 100% hexanes for 360 mL, gradient to 100% EtOAc over 4536 mL) to afford tetrabenzy1 2-[2-(tetrahydro-2H-pyran-2-yloxy)ethoxy] propane-1,3-diylbis(phosphate), as a colorless oil. \( R^f = 0.64 \) (EtOAc). LCMS calc. = 763.24; found = 763.21 (M+Na)⁺. ¹H NMR (500 MHz, CHCl₃): δ 7.39-7.27 (m, 20 H); 5.1-4.94 (m, 8 H); 4.52 (br s, 1 H); 4.14-3.95 (m, 4 H); 3.80-3.59 (m, 5 H); 3.51-3.34 (m, 2 H); 1.76-1.59 (m, 2 H); 1.52-1.47 (m, 2 H); 1.45 (br s, 2 H).

**Step D**: Tetrabenzy1 2-(2-hydroxyethoxy)propane-1,3-diylbis(phosphate)

A solution of tetrabenzy1 2-[2-(tetrahydro-2H-pyran-2-yloxy)ethoxy]propane-1,3-diylbis(phosphate) (84.3 mg, 0.14 mmol) and pyridinium p-toluenesulfonate (2.86 mg, 0.011 mmol) in EtOH (1.14 mL) was stirred at 55 °C for 4 h. The reaction mixture was cooled to room temperature and diluted with EtOAc (25 mL), washed with saturated NaHCO₃ (10 mL), dried (Na₂SO₄) and concentrated in vacuo to afford tetrabenzy1 2-(2-hydroxyethoxy)propane-1,3-diylbis(phosphate). LCMS calc. = 657.20; found = 657.06 (M+H)⁺. ¹H NMR (500 MHz, CHCl₃): δ
7.40-7.28 (m, 20 H); 5.10-4.95 (m, 8 H); 4.14-4.04 (m, 2 H); 4.03-3.92 (m, 2 H); 3.76-3.67 (m, 1 H); 3.67-3.56 (m, 2 H); 3.57-3.44 (m, 2 H).

INTERMEDIATE

Tetrabenzyl 2-(4-hydroxy-3-isopropoxyphenoxy)propane-1,3-diylbisC phosphate

Step A: 4-(Benzyloxy)-2-isopropoxybenzaldehyde

K<sub>2</sub>CO<sub>3</sub> (6.14 g, 44.4 mmol) and 2-iodopropane (1.28 mL, 12.76 mmol) were added successively to a stirred solution of 4-benzyloxy-2-hydroxybenzaldehyde (2.33 g, 10.21 mmol) in dry DMF (12.8 mL) at 25 °C under N<sub>2</sub>. The reaction was heated at 50 °C overnight. The reaction was diluted with water (50 mL) and extracted with Et<sub>2</sub>O (3 x 50 mL). The combined extracts were dried (MgSO<sub>4</sub>) and concentrated <i>in vacuo</i> to afford the crude product. This was azeotroped from toluene to afford 4-(benzyloxy)-2-isopropoxybenzaldehyde. LCMS calc. = 293.1; found = 292.9 (M+Na)<sup>+</sup>.

Step B: 4-(Benzyloxy)-2-isopropoxyphenol

A solution of 4-(benzyloxy)-2-isopropoxybenzaldehyde (2.76 g, 10.21 mmol) and 30 wt% hydrogen peroxide (1.35 mL, 13.07 mmol) in conc. H<sub>2</sub>SO<sub>4</sub> (0.204 mL) and MeOH (20.4 mL) was stirred for 3 h at 25 °C under N<sub>2</sub>. After this time the mixture was diluted with water (20 mL) and extracted with CH<sub>2</sub>Cl<sub>2</sub> (3 x 30 mL). The combined extracts were dried (MgSO<sub>4</sub>) and concentrated <i>in vacuo</i> to afford 4-(benzyloxy)-2-isopropoxyphenol, as a colorless oil. LCMS calc. = 281.1; found = 281.0 (M+Na)<sup>+</sup>.

Step C: 4-(Benzyloxy)-2-isopropoxyphenyl benzoate

Triethylamine (4.27 mL, 30.7 mmol) was added to a solution of 4-(benzyloxy)-2-isopropoxyphenol (2.64 g, 10.22 mmol) in dry CH<sub>2</sub>Cl<sub>2</sub> (40.9 mL) and the resulting solution was cooled to 0 °C. Benzoyl chloride (1.54 mL, 13.29 mmol) was added dropwise and the reaction was stirred at 25 °C overnight. The reaction mixture was washed with water (50 mL). The aqueous layer was separated and extracted with CH<sub>2</sub>Cl<sub>2</sub> (2 x 20 mL). The combined organic layers were dried (MgSO<sub>4</sub>) and concentrated <i>in vacuo</i> to give the crude product. This was
azeoptoped with toluene to afford 4-(benzyloxy)-2-isopropoxyphenyl benzoate. LCMS calc. = 385.1; found = 385.0 (M+Na)⁺. ¹H NMR (500 MHz, CHCl₃): δ 8.25-8.21 (2 H, m), 7.66-7.60 (1 H, m), 7.52 (2 H, J = 7.7 Hz), 7.47 (2 H, d, J = 7.5 Hz), 7.44-7.39 (2 H, m), 7.39-7.33 (1 H, m), 7.12-7.05 (1 H, m), 6.73-6.68 (1 H, m), 6.60 (1 H, dd, J = 8.7, 2.8 Hz), 5.07 (2 H, s), 4.54-4.43 (1 H, m). 1.27 (6 H, t, J = 6.1 Hz).

Step D: 4-Hydroxy-2-isoproxyphenyl benzoate

A suspension of 10% palladium on carbon (0.543 g, 0.510 mmol) in a solution of 4-(benzyloxy)-2-isoproxyphenyl benzoate (3.70 g, 10.21 mmol) in 25 mL of EtOAc and EtOH (5 mL) was shaken in a Parr shaker under H₂ (45 psi) at 25 °C for 3 days. The reaction mixture was filtered through a plug of Celite and the filtrate was concentrated in vacuo to afford the crude product. This was purified by flash chromatography (Biotage Horizon, 40 M₅ Si, ~30 mL/min, 100% hexanes for 360 mL, gradient to 25% EtOAc in hexanes over 4536 mL) to afford 4-hydroxy-2-isoproxyphenyl benzoate. Rf = 0.28 (20% EtOAc in hexanes). LCMS calc. = 295.10; found = 295.07 (M+Na)⁺. ¹H NMR (500 MHz, CHCl₃): δ 8.22 (d, J = 7.8 Hz, 2 H); 7.64 (t, J = 7.4 Hz, 1 H); 7.51 (t, J = 7.7 Hz, 2 H); 6.94 (d, J = 8.6 Hz, 1 H); 6.49 (d, J = 2.7 Hz, 1 H); 6.35 (dd, J = 8.6, 2.7 Hz, 1 H); 4.39 (p, J = 6.1 Hz, 1 H); 1.22 (d, J = 6.1 Hz, 6 H).

Step E: 2-Isopropoxy-4-[(2-phenyl-1,3-dioxan-5-yl)oxy]phenyl benzoate

Diethyl azodicarboxylate (173 μL, 1.102 mmol) was added to a stirred solution of 4-hydroxy-2-isoproxyphenyl benzoate (200 mg, 0.734 mmol), 1,3-benzylidene glycerol (159 mg, 0.881 mmol) and triphenylphosphine (289 mg, 1.102 mmol) in dry THF (7.34 mL) at room temperature under N₂. The reaction was heated at reflux overnight. Another 1.5 eq of Ph₃P and DEAD were added and the reaction was heated at reflux for another 5 h. The reaction mixture was concentrated in vacuo to afford the crude product. This was purified by flash chromatography (Biotage Horizon, 25 M₅ Si, ~20 mL/min, 100% hexanes for 144 mL, gradient to 25% EtOAc in hexanes over 2394 mL) to afford 2-isopropoxy-4-[(2-phenyl-1,3-dioxan-5-yl)oxy]phenyl benzoate, as a colorless solid. Rf = 0.67 (20% EtOAc in hexanes). LCMS calc. = 435.18; found = 435.18 (M+H)⁺. ¹H NMR (500 MHz, CHCl₃): δ 8.26 (d, J = 7.8 Hz, 2 H); 7.66 (t, J = 7.5 Hz, 1 H); 7.60-7.51 (m, 4 H); 7.47-7.39 (m, 3 H); 7.12 (d, J = 8.7 Hz, 1 H); 6.68 (d, J = 2.8 Hz, 1 H); 6.63 (dd, J = 8.7, 2.7 Hz, 1 H); 5.56 (s, 1 H); 4.68-4.57 (m, 3 H); 4.53 (p, J = 6.1 Hz, 1 H); 3.87 (t, J = 9.8 Hz, 2 H); 1.31 (d, J = 6.1 Hz, 6 H).

Step F: 4-r2-Hydroxy-1-(hydroxymethyl)ethoxy]-2-isopropoxy phenyl benzoate

A suspension of 10% palladium on carbon (38.9 mg, 0.037 mmol) in a solution of 2-isopropoxy-4-[(2-phenyl-1,3-dioxan-5-yl)oxy]phenyl benzoate (158.7 mg, 0.365 mmol) in EtOAc (3.65 mL) was stirred under H₂ (double balloon pressure) at 25 °C for 4 days. The
reaction mixture was filtered through a plug of Celite and the filtrate was concentrated in vacuo to afford the crude product. This was purified by flash chromatography (Biotage Horizon, 25M, Si, 20 mL/min, 100% hexanes for 144 mL, gradient to 100% EtOAc over 2394 mL) to afford 4-[2-hydroxy-1-(hydroxymethyl)ethoxy]-2-isopropoxyphenyldibenzoate, as a colorless solid. Rf = 0.17 (50% EtOAc in hexanes). LC/MS calc. = 347.15; found = 347.06 (M+H)+. 1H NMR (500 MHz, CDCl3); δ 8.18 (d, J = 7.8 Hz, 2 H); 7.61 (t, J = 7.5 Hz, 1 H); 7.49 (t, J = 7.7 Hz, 2 H); 7.03 (d, J = 8.7 Hz, 1 H); 6.68 (d, J = 2.7 Hz, 1 H); 6.56 (dd, J = 8.8, 2.7 Hz, 1 H); 4.45 (p, J = 6.1 Hz, 1 H); 4.34 (p, J = 4.8 Hz, 1 H); 3.89-3.80 (m, 4 H); 2.88 (s, 2 H); 1.23 (d, J = 6.1 Hz, 6 H).

Step G: 4-[2-{[bis(benzyloxy)phosphoryl]oxy}-1-\[2-(hydroxy)methyl]ethoxy]-2-isopropoxyphenyl benzoate

Dibenzy N,N-diisopropylphosphoramidite (258 µL, 0.769 mmol) was added to a stirred solution of ltf-tetrazole (0.45 M in CH3CN) (3418 µL, 1.538 mmol) and 4-[2-hydroxy-1-(hydroxymethyl)ethoxy]-2-isopropoxyphenyl benzoate (88.8 mg, 0.256 mmol) in dry CH2Cl2 (9.50 mL) at 25 °C under N2. The reaction was stirred for 3 h at 25 °C. The reaction mixture was cooled to 0 °C and a solution of 3-chloroperoxybenzoic acid (230 µL, 1.025 mmol) in dry CH2Cl2 (4.75 mL) was added via cannula and the reaction was stirred at 0 °C. After 60 min the reaction was diluted with EtOAc (25 mL) and washed with successive portions of saturated Na2SO3 (20 mL) and saturated NaHCO3 (20 mL), dried (Na2SO4) and concentrated in vacuo to afford the crude product. This was purified by flash chromatography (Biotage Horizon, 25M, Si, 20 mL/min, 100% hexanes for 144 mL, gradient to 75% EtOAc in hexanes over 2394 mL) to afford 4-[2-{[bis(benzyloxy)phosphoryl]oxy]-1-\[2-(hydroxy)methyl]ethoxy]-2-isopropoxyphenyl benzoate, as a colorless oil. Rf = 0.41 (50% EtOAc in hexanes). LC/MS calc. = 867.27; found = 867.14 (M+H)+. 1H NMR (500 MHz, CDCl3); δ 8.20 (d, J = 7.7 Hz, 2 H); 7.63 (t, J = 7.5 Hz, 1 H); 7.51 (t, J = 7.7 Hz, 2 H); 7.44-7.20 (m, 20 H); 6.98 (d, J = 8.7 Hz, 1 H); 6.61 (d, J = 2.8 Hz, 1 H); 6.44 (dd, J = 8.7, 2.8 Hz, 1 H); 5.08-4.98 (m, 8 H); 4.44 (p, J = 5.0 Hz, 1 H); 4.36 (p, J = 6.1 Hz, 1 H); 4.14 (dd, J = 7.2, 5.0 Hz, 4 H); 1.18 (d, J = 6.1 Hz, 6 H).

Step H: Tetrabenzyl-12-(4-hydroxy-3-isopropoxyphenoxy)propane-1,3-diylbis( phosphate) 0.1% (w/v) NaOH in water/MeOH (1:9) (1737 µL, 0.043 mmol) was added to a stirred solution of 4-[2-{[bis(benzyloxy)phosphoryl]oxy}-1-\[2-(hydroxy)methyl]ethoxy]-2-isopropoxyphenyl benzoate (125.5 mg, 0.145 mmol) in MeOH (4.83 mL) at 25 °C. Another 3 x 0.3 eq 0.1% (w/v) NaOH in water/MeOH were added. After 24 h, the reaction mixture was concentrated in vacuo to remove most of the MeOH. The aqueous mixture was diluted with water (10 mL) and 1N HCl (5 mL)
and extracted with EtOAc (3 x 15 mL). The combined extracts were dried (Na$_2$SO$_4$) and concentrated in vacuo to give the crude product. This was purified by flash chromatography (Biotage Horizon, 25M, Si, -20 mL/min, 100% hexanes for 144 mL, gradient to 100% EtOAc over 2394 mL) to afford tetrabenzyl 2-(4-hydroxy-3-isopropoxyphenoxy)propane-l,3-diylbis(phosphate), as a colorless oil. $R' = 0.19$ (50% EtOAc in hexanes). LCMS calc. = 763.24; found = 763.07 (M+H)$^+$. $^1$H NMR (500 MHz, CDCl$_3$): $\delta$ 7.31 (m, 20 H); 6.77 (d, $J = 8.7$ Hz, 1 H); 6.54 (d, $J = 2.7$ Hz, 1 H); 6.37 (dd, $J = 8.7$, 2.7 Hz, 1 H); 5.67 (s, 1 H); 5.07-4.98 (m, 8 H); 4.41 (p; $J = 6.1$ Hz, 1 H); 4.34 (p, $J = 5.00$ Hz, 1 H); 4.14 (t, $J = 6.1$ Hz, 4 H); 1.28 (d, $J = 6.1$ Hz, 6 H).

**EXAMPLE 1**

\[
\text{MeO} \quad \text{MeO} \\
\text{F}_3\text{C} \quad \text{Cl}^- \quad \text{H}_2\text{N}^+ \\
\text{F} \quad \text{CF}_3 \\
\text{O} \quad \text{O} \\
\text{CF}_3 \quad \text{Me} \quad \text{CF}_3
\]

$^{1}$R,2y)-l-[3,5-Bis(trifluoromethyl)phenyl-l-(j '(2,6-dimethoxyphenoxy)carbonyl]oxy]-N-{f4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifluoromethyl)phenyl-2-yl}methyl]propan-2-aminium chloride

Steυ A: (1J?,2y> -143.5-Bis(triiluoromethyl)phenyl-l-ferr-butoxycarbonvl){r4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifuromethyl)phenyl-2-yl}methyl]amino)propyl 2,6-dimethoxyphenyl carbonate

Pyridine (0.035 mL, 0.437 mmol) was added dropwise to a stirred solution of 2,6-dimethoxyphenol (67.4 mg, 0.437 mmol) and triphosgene (47.4 mg, 0.160 mmol) in dry CH$_2$Cl$_2$ (4 mL) at 0°C under N$_2$. The reaction was stirred at 25°C for 1.5 h. A solution of tert-butyl ((15',2i?)2-[3,5-bis(trifluoromethyl)phenyl]-2-hydroxy-l-methyl'ethyli {f4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifluoromethyl)phenyl-2-yl}methyl] carbamate (INTERMEDIATE 7, 155.6 mg, 0.219 mmol) in dry CH$_2$Cl$_2$ (2 mL) was added via cannula followed by dropwise addition of pyridine (0.040 mL, 0.492 mmol). The reaction was stirred at 25°C for 3 h. The reaction was diluted with water (15 mL) and extracted with EtOAc (3 x 20 mL). The combined extracts were dried (MgSO$_4$) and concentrated in vacuo to give the crude product. This was purified by flash...
chromatography (Biotage Horizon, 25M, Si, -20 nL/min, 100% hexanes for 144 mL, gradient to 20% EtOAc in hexanes over 2394 mL) to give (li,2S)-1-[3,5-bis(trifluoromethyl)phenyl]-2-((tert-butoxycarbonyl)[4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifluoromethyl)biphenyl-2-yl][methyl]amino)propyl 2,6-dimethoxyphenyl carbonate, as a colorless oil. R' = 0.51 (20% EtOAc/hexanes). LCMS calc. = 914.3; found = 914.1 (M+H)+.

Step B: (1R,2S)-1-[3,5-Bis(trifluoromethyl)phenyl]-l-{[(2,6-dimethoxyphenoyx)carbonyl]oxy}-N-[4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifluoromethyl)biphenyl-2-yl][methyl]propan-2-aminium chloride

A solution of (1R,2S)-1-[3,5-bis(trifluoromethyl)phenyl]-3-2-((tert-butoxycarbonyl)[4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifluoromethyl)biphenyl-2-yl][methyl]amino)propyl 2,6-dimethoxyphenyl carbonate (125.7 mg, 0.141 mmol) in HCl saturated EtOAc (4 mL) was stirred at 25 ºC for 5 h. The reaction mixture was concentrated in vacuo to afford (1R,2S)-1-[3,5-bis(trifluoromethyl)phenyl]-l-{[(2,6-dimethoxyphenoyx)carbonyl]oxy}-N-[4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifluoromethyl)biphenyl-2-yl][methyl]propan-2-aminium chloride, as a colorless oil/glass. LCMS calc. = 792.2; found = 792.2 (M+H)+.

The following carbonates (Table 2) were synthesized using methods analogous to those described in EXAMPLE 1 from commercially available chloroformates, chlorothioformates, phenols and alcohols. The conditions employed in EXAMPLE 1. Step B were also successful in removing any tert-butyl carbamate or ester groups present in the alcohol or phenol residue of the carbamate such as that present in INTERMEDIATE 5.

### Table 2

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**EXAMPLE 32**

![Structure Image for Example 32](image8.png)
flJ?,2,S]-l-p,S-Bis(trifluoromethyl)phenyl j-[4'-fluoro-5'-iso\propvl-2'-methoxy-4-
(trifluoromethyl)biphenyl-2-yl1methv-U-1-(2-methoxy-4-[2-
(phosphonoxy)ethyl]phenoxv)carbonyloxy] propan-2-aminiuni chloride

Step A: 4-(2-Hydroxyethyl)-2-methoxyphenyl acetate

A solution of 1-acetyl-1 H-l,2,3-triazolo[4,5-b]pyridine (0.964 g, 5.95 mmol) in
dry THF (24 mL) was added to a solution of homovanillyl alcohol (1.00 g, 5.95 mmol) in IN aq.
NaOH (5.95 mL, 5.95 mmol) at 25 °C. The reaction was stirred at 25 °C for 60 min. The
reaction was diluted with IN HCl (40 mL) and extracted with Et2O (3 x 50 mL). The combined
extracts were dried (MgSO4) and concentrated in vacuo to give the crude product. This was
purified by flash chromatography (Biotage Horizon, 4OM, Si, -30 mL/min, 100% hexanes for
144 mL, gradient to 50% EtOAc in hexanes over 360 mL, gradient to 100% EtOAc over 1944
mL) to afford 4-(2-hydroxyethyl)-2-methoxyphenyl acetate, as a colorless oil. Rf = 0.71
(EtOAc). LCMS calc. = 233.1; found = 233.1 (M+Na)+. 1H NMR (500 MHz, CDCl3): δ 6.95
d, J = 8.0 Hz, 1 H); 6.83 (d, J = 1.8 Hz, 1 H); 6.79 (dd, J = 1.8, 8.0 Hz, 1 H); 3.88 (t, J = 6.6
Hz, 2 H), 3.84 (s, 3 H); 2.82 (t, J = 6.5 Hz, 2 H); 2.30 (s, 3 H); 1.76 (s, 1 H).

Step B: 2-Methoxy-4-(2-[[4-(methylphenyl)sulfonyl]oxy]ethyl)phenyl acetate

1/7-Toluenesulfonyl chloride (2.14 mL, 11.2 mmol) was added to a stirred solution
of 4-(2-hydroxyethyl)-2-methoxyphenyl acetate (1.18 g, 5.61 mmol) in dry pyridine (20 mL) at 0
° C under N2. The reaction was stored at 4 °C for 3 days. The reaction was diluted with water (50
mL) and extracted with EtOAc (3 x 50 mL). The combined extracts were dried (MgSO4) and
concentrated in vacuo to afford 2-methoxy-4-(2-[[4-(methylphenyl)sulfonyl]oxy]ethyl)phenyl
acetate, as an oil. Product was a 6:4 mixture of desired product and starting material but carried
forward regardless. LCMS calc. = 387.1; found = 386.8 (M+Na)+.

Step C: 4-f2-Iodoethyl)-2-methoxyphenyl acetate

A 6:4 mixture of 2-methoxy-4-(2-[[4-(methylphenyl)sulfonyl]oxy]ethyl)phenyl
acetate and 4-(2-hydroxyethyl)-2-methoxyphenyl acetate (1.57 g, 4.31 mmol) and sodium iodide
(0.706 mL, 17.2 mmol) in dry acetone (28 mL) was stirred at room temperature overnight with
protection from light. The acetone was removed in vacuo and the residue was triturated with
toluene and filtered through a plug of Celite to remove insoluble inorganic material. The filtrate
was concentrated in vacuo to afford the crude product. This was purified by flash
chromatography (Biotage Horizon, 4OM, Si, ~30 mL/min, 100% hexanes for 360 mL, gradient to
50% EtOAc in hexanes over 4536 mL) to give 4-(2-iodoethyl)-2-methoxyphenyl acetate. Rf =
0.58 (20% EtOAc/hexanes). LCMS calc. = 321.0; found = 320.7 (M+H)+.

Step D: 4-(2-[[Bis(benzvloxv) phosphoryl1oxy]ethyl]-2-methoxyphenyl acetate
Silver dibenzylphosphate (0.950 g, 2.47 mmol) was added to a solution of 4-(2-iodoethyl)-2-methoxyphenyl acetate (0.79 g, 2.47 mmol) in dry toluene (20 mL) and the mixture was heated at reflux overnight. The precipitated formed was removed by filtration through a plug of Celite and washed through with toluene. The filtrate was concentrated in vacuo to give the crude product. This was purified by flash chromatography (Biotage Horizon, 4OM, Si, -30 mL/min, 100% hexanes for 360 mL, gradient to 50% EtOAc in hexanes over 4536 mL) to afford 4-(2-{[bis(benzyloxy)phosphoryl]oxy}ethyl)-2-methoxyphenyl acetate, as a colorless oil. Rf = 0.31 (50% EtOAc/hexanes). LCMS calc. = 471.2; found = 470.9 (M+Na)+. 1H NMR (600 MHz, CDCl3): δ 7.37-7.31 (m, 10 H); 6.92 (d, J = 8.0 Hz, 1 H); 6.76 (d, J = 1.8 Hz, 1 H); 6.72 (dd, J = 1.9, 8.0 Hz, 1 H); 5.01-4.95 (m, 4 H); 4.17 (q, J = 7.2 Hz, 2 H); 3.76 (s, 3 H); 2.89 (t, J = 7.0 Hz, 2 H); 2.30 (s, 3 H).

Step E: Dibenzyl 2-(4-hydroxy-3-methoxyphenyl)ethyl phosphate

K2CO3 (126 mg, 0.910 mmol) was added to a stirred solution of 4-(2-{[bis(benzyloxy)phosphoryl]oxy}ethyl)-2-methoxyphenyl acetate (214 mg, 0.455 mmol) in MeOH (30 mL) at 25 °C. The reaction was stirred at 25 °C for 1 h. The reaction mixture was concentrated in vacuo and the resulting residue was partitioned between water (20 mL) and EtOAc (20 mL). The aqueous layer was separated and extracted with EtOAc (2 x 20 mL). The combined organic extracts were dried (MgSO4) and concentrated in vacuo to afford dibenzyl 2-(4-hydroxy-3-methoxyphenyl)ethyl phosphate, as an oil. LCMS calc. = 429.2; found = 429.1 (M+Na)+.

Step F: 4-f2-{-[Bis(benzyloxy)phosphoryl]oxyethyl}-2-methoxyphenyl (IRjLS)-1-B ,5- bis(trifluoromethyl)phenyl] -2-(fert-butoxycarbonyl) {[4'-fluoro-5'-isopropyl-2'-methoxy-4- (trifluoromethyl)benzyl]methyl}amino)propyl carbonate

Pyridine (0.037 mL, 0.455 mmol) was added dropwise to a stirred solution of dibenzyl 2-(4-hydroxy-3-methoxyphenyl)ethyl phosphate (195 mg, 0.455 mmol) and triphosgene (49.3 mg, 0.166 mmol) in dry CH2Cl2 (4 mL) at 0 °C under N2. The reaction was stirred at 25 °C for 1.5 h. A solution of tert-buXY\(\{1S,2S\}\)-2-[3,5-bis(trifluoromethyl)phenyl]-2-hydroxy-1-methylethyl) \{[4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifluoromethyl)benzyl]methyl\}y carbamate (INTERMEDIATE 7, 162.0 mg, 0.228 mmol) in dry CH2Cl2 (2 mL) was added via cannula followed by dropwise addition of pyridine (0.041 mL, 0.512 mmol). The reaction was stirred at 25 °C for 3 h. The reaction was diluted with water (15 mL) and extracted with EtOAc (3 x 20 mL). The combined extracts were dried (MgSO4) and concentrated in vacuo to give the crude product. This was purified by flash chromatography (Biotage Horizon, 25M, Si, -20 mL/min, 100% hexanes for 144 mL, gradient to 50% EtOAc in hexanes over 2394 mL) to give 4-(2-{[bis(benzyloxy)phosphoryl]oxy}ethyl)-2-methoxyphenyl (IRjLS)-1-[3,5-
bis(trifluoromethyl)phenyl]-2-((fer?-butoxycarbonyl){[4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifluoromethyl)biphenyl-2-yl]methyl}amino)propyl carbonate, as a colorless oil. Rf = 0.63 (50% EtOAc/hexanes). LCMS calc. = 1166.4; found = 1166.4 (M+H)+.

Step G: fli?,2^-l-[3,5-Bis(trifluoromethyl)phenyl-2-((/er-butoxycarbonyl){[4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifluoromethyl)biphenyl-2-yl]methyl}amino)propyl 2-methoxy-4-[2-(phosphonooxy)ethyl]phenyl carbonate

A suspension of 10% palladium on carbon (7.9 mg, 0.074 mmol) in a solution of 4-(2-{[bis(benzyloxy)phosphoryl]oxy}ethyl)-2-methoxyphenyl (1R,2S)-1-[(3,5-bis(trifluoromethyl)phenyl)-2-((/er-butoxycarbonyl){[4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifluoromethyl)biphenyl-2-yl]methyl}amino)propyl 2-methoxy-4-[2-(phosphonooxy)ethyl]phenyl carbonate in ethanol (5.7 mL) was stirred under H2 (double balloon pressure) at 25 ºC for 5 h. The reaction mixture was filtered through a plug of Celite and the filtrate was concentrated in vacuo to afford (17?,25)-1-[3,5-bis(trifluoromethyl)phenyl]-2-((t e rt-butoxycarbonyl){[4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifluoromethyl)biphenyl-2-yl]methyl}amino)propyl 2-methoxy-4-[2-(phosphonooxy)ethyl]phenyl carbonate. LCMS calc. = 1008.8; found = 1008.8 (M+Na)+.

Step H: (li?,2y)-l-[3,5-Bis(trifluoromethyl)phenyl-2-((/er-butoxycarbonyl){[4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifluoromethyl)biphenyl-2-yl]methyl}amino)propyl 2-methoxy-4-[2-(phosphonooxy)ethyl]phenyl carbonate

A solution of (1R,2S)-1-[3,5-bis(trifluoromethyl)phenyl]-2-((/er-butoxycarbonyl){[4'-fluoro-5'-iso propyl-2'-methoxy-4-(trifluoromethyl)biphenyl-2-yl]methyl}amino)propyl 2-methoxy-4-[2-(phosphonooxy)ethyl]phenyl carbonate (72.9 mg, 0.074 mmol) in HCl saturated EtOAc (2 mL) was stirred at 25 ºC for 5 h. The reaction mixture was concentrated in vacuo to afford (1R,2S)-1-[3,5-bis(trifluoromethyl)phenyl]-7-[4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifluoromethyl)biphenyl-2-yl]methyl]-1-{[2-methoxy-4-[2-(phosphonooxy)ethyl]phenox y]carbonoyl]oxy}propan-2-aminium chloride, as a colorless oil/glass. LCMS calc. = 886.2; found = 886.0 (M+H)+.

The following carbonates (Table 3) were synthesized using methods analogous to those described in EXAMPLE 3 2 from commercially available alcohols or those whose syntheses are described above.
### TABLE 3

<table>
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<th>Example</th>
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EXAMPLE 44

To a solution of 4-hydroxy-3-methoxybenzylamine (1.0 g, 5.27 mmol) in acetonitrile (30 mL) was added tert-butylhydrogen carbonate (1.27 g, 5.80 mmol) and diisopropylethylamine (1.84 mL, 10.54 mmol). The reaction was stirred at room temperature for 16 h before being partitioned between EtOAc (60 mL) and water (30 mL). The aqueous phase was separated and re-extracted with EtOAc (3 x 25 mL) and the combined organic extracts were washed with brine (60 mL), dried over MgSO$_4$, filtered and concentrated. Purification by flash chromatography (40% EtOAc/hexanes) gave tert-Butyl(4-hydroxy-3-methoxybenzyl)carbamate. LCMS = 275.9 (M+H)$^+$. 
Step B: (R,2S)-1-[3,5-Bis(trifluoromethyl)phenyl]-2-((tert-butoxycarbonyl)amino)propyl-4-((4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifluoromethyl)biphenyl-2-y]methyl]carbamate

Pyridine (0.048 mL, 0.587 mmol) was added dropwise to a stirred solution of tert-butyl(4-hydroxy-3-methoxybenzyl)carbamate (149 mg, 0.587 mmol) and trichloroethylene (64 mg, 0.214 mmol) in dry CH₂Cl₂ (4.0 mL) at 0 °C under N₂. The reaction was stirred at 25 °C for 1.5 h. A solution of tert-butyl ((1,5,2R)-2-[3,5-bis(trifluoromethyl)phenyl]-2-hydroxy-l-methylethyl) [(4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifluoromethyl)biphenyl-2-y]methyl]carbamate (INTERMEDIATE 7, 209 mg, 0.294 mmol) in dry CH₂Cl₂ (2 mL) was added followed by dropwise addition of pyridine (0.053 mL, 0.587 mmol). The reaction was stirred at 25 °C for 3 h. The reaction was diluted with water (15 mL) and extracted with EtOAc (3 x 20 mL). The combined extracts were dried (MgSO₄) and concentrated in vacuo to give the crude product. This was purified by flash chromatography (0-20% gradient EtOAc/hexanes over 30 min) to give (l/t,2S)-1-[3,5-bis(trifluoromethyl)phenyl]-2-((tert-butoxycarbonyl)amino)propyl-4-([[(4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifluoromethyl)biphenyl-2-y]methyl]amino)propyl-4-((4'-methoxyphenyl)carbamate as a colorless oil. Rf = 0.51 (20% EtOAc/hexanes). LCMS calc. = 990.9; found = 991.3 (M+H)+.

Step C: (R,2S)-1-(4-(Ammoniomethyl)isopropyl-2-methoxyphenoxy)-3-fluorophenyl-1-methyl propan-2-amine dichloride

A solution of (R,2S)-1-[3,5-bis(trifluoromethyl)phenyl]-2-((tert-butoxycarbonyl) [(4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifluoromethyl)biphenyl-2-y]methyl]amino)propyl-4-((4'-tert-butoxycarbonyl)amino)methyl]-2-methoxyphenyl carbonic anhydride (50 mg, 0.050 mmol) in HCl saturated EtOAc (3 mL) was stirred at 25 °C for 3 h. The reaction mixture was concentrated in vacuo to afford (R,2S)-1-((4-ammoniomethyl)-2-methoxyphenoxy)carbonyl)-1-[3,5-bis(trifluoromethyl)phenyl]-4-((4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifluoromethyl)biphenyl-2-y]methyl)propan-2-aminium dichloride as a white solid. LCMS calc. = 790.7; found = 791.1 (M+H)+.
EXAMPLE 45

\[
\text{MeO} \quad \text{F} \\
\text{F}_3 \quad \text{C} \\
\text{Cl} \quad \text{H}_2 \quad \text{N}^+ \\
\text{HO-PO-OC-OC-} \\
\text{CF}_3 \\
\text{HO}
\]

(\[7j^{\text{Si}}\times 7\]-[3,5-Bis(trifluoromethyl)phenyl]-N-i4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifluoromethyl)phenyl]-2-yl[methyl]-1J-dihydroxy-5-oxo-6,2,4,5-tetraoxa-1-phosphanonan-8-aminium-1-oxide chloride)

Step A: ([1R,2S]-1-j-3,5-Bis(trifluoromethyl)phenyl)-2-fert-butoxycarbonyl)-2'-isopropyl-2'-methoxy-4-(trifluoromethyl)phenyl-2-[4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifluoromethyl)biphenyl-2-yl]-methyl]amino)propyl chloromethyl carbonate

Chloromethyl chloroformate (0.027 mL, 0.30 mmol) was added dropwise to a stirred solution of tert-butyl ([15,2i]-2-[3,5-bis(trifluoromethyl)phenyl]-2-hydroxy-1-methylethyl] [[4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifluoromethyl)biphenyl-2-yl[methyl]carbamate (INTERMEDIATE 7, 209 mg, 0.294 mmol) (200 mg, 0.28 mmol) and proton sponge (60 mg, 0.28 mmol) in dry CH₂Cl₂ (5.0 mL) at 0 °C under N₂. The reaction was stirred at 25 °C for 16 h. The reaction was diluted with water (30 mL) and extracted with EtOAc (3 x 30 mL). The combined extracts were dried (MgSO₄) and concentrated in vacuo to give the crude product. This was purified by flash chromatography (0-20% gradient EtOAc/hexanes over 30 min) to give (li?-2S)-l-[3,5-bis(trifluoromethyl)phenyl]-2-(fert-butoxycarbonyl) [[4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifluoromethyl)biphenyl-2-yl[methyl] amono) propyl chloromethyl carbonate as a colorless oil. 1H NMR (500 MHz, CDCl₃): δ 7.81-6.82 (m, 8 H); 7.08 (dd, J = 8.3 Hz, 8.7 Hz, 1 H); 5.68 (m, 2 H); 4.19-4.16 (d, J = 16.7 Hz, 1 H); 4.77 (s, 3 H), 3.31-3.24 (m, 1 H); 1.76 (s, 3 H); 1.41 (s, 3 H); 1.22-1.18 (s, 9 H), 1.04 (d, J = 6.6 Hz, 3 H).

Step B: ([Bis(benzyloxyl)phosphoryl]oxy)methylf IR2S]-L-j3,5-bis(trifluoromethyl)phenyl-1-2-flor-butoxycarbonyl) [[4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifluoromethyl)biphenyl-2-yl[methyl] amono) propyl carbonate
Silver dibenzylphosphate (22 mg, 0.056 mmol) was added to a solution of (1R,2S)-1-[3,5-bis(trifluoromethyl)phenyl]-2-(tert-butoxycarbonyl) [4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifluoromethyl)biphenyl-2-yl]methyl]amino)propyl chloromethyl carbonate (45 mg, 0.056 mmol) in dry toluene (3 mL) and the mixture was heated at reflux for 16 h. The precipitate formed was removed by filtration through a plug of Celite and washed with toluene (3 x 15 mL). The filtrate was concentrated in vacuo to give the crude product. This was purified by flash chromatography (0-20% EtOAc/hexanes) to afford [(Ms(benzyloxy)phosphoryl]oxy)methyl(1R,2S)-1-[3,5-bis(trifluoromethyl)phenyl]-2-(tert-butoxycarbonyl) [4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifluoromethyl)biphenyl-2-yl]methyl]amino)propyl carbonate, as a colorless oil. LCMS caic. = 1045.89; found = 1068.2 (M+Na)+.

Step C: riJ?;y)-(1-[3,5-Bis trifluoromethylnphenyl]-2-2-(fer tert-butoxycarbonyl) [4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifluoromethyl)biphenyl-2-yl]methyl]amino)propyl carbonate  
A suspension of 10% palladium on carbon (4.0 mg) and [(Ms(benzyloxy)phosphoryl]oxy)methyl(1R,2S)-1-[3,5-bis(trifluoromethyl)phenyl]-2-(tert-butoxycarbonyl) [4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifluoromethyl)biphenyl-2-yl]methyl]amino)propyl carbonate (17 mg, 0.016 mmol) in ethyl acetate (2.0 mL) was stirred under H2 (double balloon pressure) at 25 °C for 16 h. The reaction mixture was filtered through a plug of Celite and the filtrate was concentrated in vacuo to afford (1R?,2S)-1-[3,5-bis(trifluoromethyl)phenyl]-2-(toret-butoxycarbonyl) [4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifluoromethyl)biphenyl-2-yl]methyl]amino)propyl (phosphonooxy)methyl carbonate. LCMS calc. = 865.2; found = 887.9 (M+Na)+.

Step D:(IRSS)- 1-[3,5-Bis trifluoromethylnphenyl]-4-(4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifluoromethyl)biphenyl-2-yl)methyl]-1,1-dihydroxy-5-oxo-^A 6-trioxa-1- phosphanooxy-8-aminium-1-oxide chloride  
A solution of (li?,2S)-1-[3,5-bis(trifluoromethyl)phenyl]-2-(fer tert-butoxycarbonyl) [4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifluoromethyl)biphenyl-2-yl]methyl]amino)propyl (phosphonooxy)methyl carbonate (9 mg, 0.010 mmol) in HCl saturated EtOAc (3 mL) was stirred at 25 °C for 3 h. The reaction mixture was concentrated in vacuo to afford (7i?,85)-7-[3,5-bis(trifluoromethyl)phenyl]-N-;[4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifluoromethyl)biphenyl-2-yl]methyl]-1,1-dihydroxy-5-oxo-2,4,6-trioxa-1-phosphanooxy-8-aminium-1-oxide chloride, as a colorless oil/glass. LCMS calc. = 801.2; found = 803.4 (M+H)+.
EXAMPLE 46

Step A:

Benzyl (6\textsuperscript{R,S})-6-[3,5-bis(trifluoromethyl)phenyl]-8-[[4\textsuperscript{′}-fluoro-5\textsuperscript{′}-isopropyl-2\textsuperscript{′}-methoxy-4-(trifluoromethyl)biphenyl-2-yl]methyl\]-7,1,1,1-trimethyl-4,9-dioxo-3,5,10-trioxa-8-azadodecan-1-oate

Pyridine (0.037 mL, 0.46 mmol) was added dropwise to a stirred solution of benzyl glycolate (76 mg, 0.46 mmol) and triphosgene (42 mg, 0.14 mmol) in dry CH\textsubscript{2}Cl\textsubscript{2} (4.0 mL) at 0 °C under N\textsubscript{2}. The reaction was stirred at 25 °C for 1.5 h. A solution of \textit{ tert}-butyl \{(15\textsuperscript{'},2\textsuperscript{+})-2-[3,5-(trifluoromethyl)phenyl]-2-hydroxy-1-methylethyl\}-[4\textsuperscript{′}-fluoro-5\textsuperscript{′}-isopropyl-2\textsuperscript{′}-methoxy-4-(trifluoromethyl)biphenyl-2-yl]methyl\} carbamate (INTERMEDIATE 7, 100 mg, 0.294 mmol) in dry CH\textsubscript{2}Cl\textsubscript{2} (2 mL) was added followed by dropwise addition of pyridine (0.017 mL, 0.21 mmol). The reaction was stirred at 25 °C for 1 h. The reaction was diluted with water (15 mL) and extracted with EtOAc (3 x 20 mL). The combined extracts were dried (MgSO\textsubscript{4}) and concentrated in vacuo to give the crude product. This was purified by flash chromatography (0-20% gradient EtOAc/hexanes over 30 min) to give benzyl(6\textsuperscript{R,S})-6-[3,5-bis(trifluoromethyl)phenyl]-8-[[4\textsuperscript{′}-fluoro-5\textsuperscript{′}-isopropyl-2\textsuperscript{′}-methoxy-4-(trifluoromethyl)biphenyl-2-yl]methyl\]-7,1,1,1-trimethyl-4,9-dioxo-3,5,10-trioxa-8-azadodecan-1-oic acid as a colorless oil. Rf = 0.51 (20% EtOAc/hexanes). LCMS calc. = 903.8; found = 926.0 (M+Na\textsuperscript{+}).

Step B: (6\textit{R,7\textsuperscript{S}})-6-[3,5-Bis(trifluoromethylnphenyl]-8-[[4\textsuperscript{′}-fluoro-5\textsuperscript{′}-isopropyl-2\textsuperscript{′}-methoxy-4-(trifluoromethyl)biphenyl-2-yl]methyl\]-7,1,1,1-trimethyl-4,9-dioxo-3,5,10-trioxa-8-azadodecan-1-oic acid

A suspension of 10% palladium on carbon (3.0 mg), benzyl(6\textsuperscript{R,S})-6-[3,5-bis(trifluoromethyl)phenyl]-8-[[4\textsuperscript{′}-fluoro-5\textsuperscript{′}-isopropyl-2\textsuperscript{′}-methoxy-4-(trifluoromethyl)biphenyl-2-yl]methyl\]-7,1,1,1-trimethyl-4,9-dioxo-3,5,10-trioxa-8-azadodecan-1-oate (25 mg, 0.028...
mmol) and 1-methyl 1,4-cyclohexadiene (26 mg, 0.28 mmol) in ethanol (2.0 mL) was stirred at 25 °C for 16 h. The reaction mixture was filtered through a plug of Celite and the filtrate was concentrated in vacuo to (6R,7S)-6-[3,5-bis(trifluoromethyl)phenyl]-8-{[4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifluoromethyl)biphenyl-2-yl]methyl}-7,11,11-trimethyl-4,9-dioxo-3,5,10-trioxa-8-azadodecan-1-oic acid. LCMS calc. = 813.7; found = 835.9 (M+Na)±.

Step C: (1R,2S)-1-[3,5-Bis(trifluoromethyl)phenyl]-1-{[(carboxymethoxy)carbonyl]oxy-N-4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifluoromethyl)biphenyl-2-yl]methyl}propan-2-aminium chloride

A solution of (6R,7S)-β-IS^-bis(trifluoromethyl)phenyll-S-t [4'-fluoro-S'-isopropyl-2'-methoxy-4-(trifluoromethyl)biphenyl-2-yl]methyl]-7,1 1,11-trimethyl-4,9-dioxo-3,5,10-trioxa-8-azadodecan-1-oic acid (6 mg, 0.007 mmol) in HCl saturated EtOAc (2 mL) was stirred at 25 °C for 3 h. The reaction mixture was concentrated in vacuo to afford (1/?,2S)-I-[3,5-bis(trifluoromethyl)phenyl]-1-{{(carboxymethoxy)carbonyl}oxy}-{N-4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifluoromethyl)biphenyl-2-yl3methyl}propan-2-aminium chloride, as a colorless oil/glass. LCMS calc. = 713.6; found = 713.9 (M+H)+.

EXAMPLE 47

(8J;9S)-8-r3,5-bis(trifluoromethvphenyl)VIP-[4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifluoromethyl)biphenyl-2-yl]methyU -1,1-dihydroxy-6-oxo-4-{[( phosphonooxy)methyl]-2,5^± -trioxa-1 λ^5-phosphadecan-9-aminium 1-oxide chloride

- 40 -
Step A: (IR2SD-1)-[3,5-Bisdiifluoromeihvnph_enyl1-2-((aerf-butoxycarbonvn (f4'-fluoro-5'-isopropyl-2'-methoxy-4-((trifluorometh yl)biphenyl-2-yl]methyl] amino)propyl 2-phenyl-1,3-dioxan-5-yl carbonate

Pyridine (0.035 mL, 0.437 mmol) was added dropwise to a stirred solution of 1,3-benzyldene glycerol (79 mg, 0.437 mmol) and triphosgene (47.4 mg, 0.160 mmol) in dry CH₂Cl₂ (4.00 mL) at 0 °C under N₂. The reaction was stirred at 25 °C for 1.5 h. A solution of tert-butyl [(15.2i?)-2-[3,5-bis(trifluoromethyl)phenyl]-2-hydroxy-l-methylethyl] {[4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifluoromethyl)biphenyl-2-yl]methyl}amino)propyl 2-phenyl-1,3-dioxan-5-yl carbonate (155.6 mg, 0.219 mmol) in dry CH₂Cl₂ (2.00 mL) was added via canula followed by dropwise addition of pyridine (0.040 mL, 0.492 mmol). The reaction was stirred overnight at 25 °C. The reaction was diluted with water (15 mL) and extracted with EtOAc (3 x 20 mL). The combined extracts were dried (MgSO₄) and concentrated in vacuo to give the crude product. This was purified by flash chromatography (Biotage Horizon, 25M, Si, ~20 mL/min, 100% hexanes for 144 mL, gradient to 20% EtOAc in hexanes over 2394 mL) to afford (U?;2S)-1-[3,5-bis(trifluoromethyl)phenyl]-2-((tert-butoxycarbonyl){[4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifluoromethyl)biphenyl-2-yl]methyl]amino)propyl 2-phenyl-1,3-dioxan-5-yl carbonate, as a colorless oil. Rf = 0.46 (20% EtOAc in hexanes). LCMS calc. = 940.29; found = 940.10 (M+Na)+.

Step B: (IR2S)-1-r3,5-Bis trifluoromethyl)phenyl]-2-((fe^-butoxycarbylonyl) {[4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifluoromethyl)biphenyl-2-yl]methyl] amino)propyl 2-hydroxy-1-(hydroxymethyl)Dethyl carbonate

A suspension of 10% palladium on carbon (9.13 mg, 8.57 μmol) in a solution of (I(i?;25)-1-[3,5-bis(trifluoromethyl)phenyl]-2-((‘r ‘butoxy carbonyl) {[4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifluoromethyl)biphenyl-2-yl]methyl] amino)propyl 2-phenyl-1,3-dioxan-5-yl carbonate (78.7 mg, 0.086 mmol) in EtOAc (6.60 mL) was stirred under H₂ (double balloon pressure) at 25 °C for 15 h. The reaction mixture was filtered through a plug of Celite and the filtrate was concentrated in vacuo to afford (II?;25)-1-[3,5-bis(trifluoromethyl)phenyl]-2-((‘r ‘butoxy carbonyl) {[4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifluoromethyl)biphenyl-2-yl]methyl] amino)propyl 2-hydroxy-1-(hydroxymethyl)ethyl carbonate. LCMS calc. = 852.26; found = 852.10 (M+Na)+.

Step C: 2-((Bis(benzyloxy)phosphoryl)] oxy)-1-(([(bis(benzyloxy) phosphoryl]oxy]methyl)ethyl fli?;2^A-l-f3,5-bis trifluoromethylDphenyl]-2-(( ‘betoxy carbonyl) {[4'-fluoro-5'-isopropyl-2'-methoxy-4-ftrifluoromethyl)biphenyl-2-yl]methyl] amino)propyl carbonate

Dibenzyl N,N-diisopropylphosphoramidite (78 μL, 0.23 l mmol) was added to a stirred solution of l//-tetrazole (0.45 M in CH₃CN) (1027 μL, 0.462 mmol) and (IR2S)-l-[3,5-
bis(trifluoromethyl)phenyl)-2-((tert-butoxycarbonyl){[4-fluoro-5-isopropyl-2'-methoxy-4-(trifluoromethyl)biphenyl-2-yl]methyl}amino)propyl 2-hydroxy-l-(hydroxymethyl)ethyl carbonate (63.9 mg, 0.077 mmol) in dry CH₂Cl₂ (2.85 mL) at 25 °C under N₂. The reaction was stirred for 3 h at 25 °C. The reaction mixture was cooled to 0 °C and a solution of 3-chloroperoxybenzoic acid (69.0 µL, 0.308 mmol) in dry CH₂Cl₂ (1.43 mL) was added via cannula and the reaction was stirred at 0 °C. After 60 min the reaction was diluted with EtOAc (25 mL) and washed with successive portions of saturated Na₂SO₃ (20 mL) and saturated NaHCO₃ (20 mL), dried (Na₂SO₄) and concentrated in vacuo to afford (8if,95)-8-[3,5-bis(trifluoromethyl)phenyl]-N-[[4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifluoromethyl)biphenyl-2-yl]methyl]amino)propyl carbonate, as a colorless oil. \( R_f = 0.61 \) (50% EtOAc in hexanes).

LCMS calc. = 1350.40; found = 1350.47 (M+H)⁺.

**Step D:** (lJ?,2S)-1-r3.5-Bis(trifluoromethylphenyl)2-((fe^2-butoxycarbonv{[4-fluoro-5'-isopropyl-2'-methoxy-4-((trifluoromethyl)biphenyl-2-yl)methyl]amino)propyl2-(phosphonooxy)-1-[(Yphosphonooxy)methyl]ethyl carbonate

A suspension of 10% palladium on carbon (6.0 mg, 5.65 µmol) in a solution of 2-[(bis(benzyloxy)phosphoryl]oxy]-1-((bis(benzyloxypophosphoryl)oxy){3.5-bis(trifluoromethyl)biphenyl)-2-((tert-butoxycarbonyl){4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifluoromethyl)biphenyl-2-yl}methyl]amino)propyl carbonate in ethanol (4.35 mL) was stirred under H₂ (double balloon pressure) at 25 °C for 3 h. The reaction mixture was filtered through a Teflon filter and the filtrate was concentrated in vacuo to afford (lJ?,2S)-1-[3.5-bis(trifluoromethyl)phenyl]-2-((tert-butoxycarbonyl){4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifluoromethyl)biphenyl-2-yl}methyl]amino)propyl 2-(phosphonooxy)-1-[(phosphonooxy)methyl]ethyl carbonate. LCMS calc. = 1012.19; found = 1012.20 (M+Na)⁺.

**Step E:** (8R,9S)-8-[3.5-Bis(trifluoromethyl)phenyl]-AM f4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifluoromethyl)biphenyl-2-yl]methylU-1,1-dihydroxy-6-oxo-4-[(phosphonooxy)methyl]-2,5,7-trioxa-1,5-phosphadecan-9-aminium oxide chloride

A solution of (lJ?,2S)-1-[3.5-bis(trifluoromethyl)phenyl]-2-((tert-butoxycarbonyl){4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifluoromethyl)biphenyl-2-yl}methyl]amino)propyl 2-(phosphonooxy)-1-[(phosphonooxy)methyl]ethyl carbonate (46.7 mg, 0.047 mmol) in HCl saturated EtOAc (3 mL) was stirred at 25 °C for 1 h. The reaction mixture was concentrated in vacuo to afford (8lf,95)-8-[3.5-bis(trifluoromethyl)phenyl]-IV-\{4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifluoromethyl)biphenyl-2-yl\}methyl]amino)propyl 2-(phosphonooxy)-1-[(phosphonooxy)methyl]ethyl carbonate (25 µL, 0.022 mmol) in dry CH₂Cl₂ (1.43 mL) at 25 °C under N₂. The reaction was stirred for 2 h at 25 °C. The reaction mixture was cooled to 0 °C and a solution of 3-chloroperoxybenzoic acid (69.0 µL, 0.308 mmol) in dry CH₂Cl₂ (1.43 mL) was added via cannula and the reaction was stirred at 0 °C. After 60 min the reaction was diluted with EtOAc (25 mL) and washed with successive portions of saturated Na₂SO₃ (20 mL) and saturated NaHCO₃ (20 mL), dried (Na₂SO₄) and concentrated in vacuo to afford (8if,95)-8-[3,5-bis(trifluoromethyl)phenyl]-N-[[4'-fluoro-5'-isopropyl-2'-methoxy-4-(trifluoromethyl)biphenyl-2-yl]methyl]amino)propyl carbonate, as a colorless oil. \( R_f = 0.61 \) (50% EtOAc in hexanes).

LCMS calc. = 1350.40; found = 1350.47 (M+H)⁺.
isopropyl-2'-methoxy-4-(trifluoromethyl)biphenyl-2-yl)methyl] - 1,1-dihydroxy-6-oxo-4-
[(phosphonoxy)methyl]-2,5,7-trioxa-1λ5-phosphadecan-9-aminiumoxide chloride, as a
colorless glass/solid. LCMS calc. = 890.16; found = 890.00 (M+H)^+.

EXAMPLE 48

Cyclization Reactions

The kinetics of the cyclization reactions of the compounds described herein could
be followed by the procedure illustrated below for the compound of EXAMPLE 35.

The sodium salt of EXAMPLE 35 (20 mg, 0.025 mmol) was dissolved (sonicated
to ensure dissolution) in 100 mM sodium phosphate buffer in D_2O (pH 7.52, 2.2 mL) and heated
at 37 °C in an oil bath. 50 µL aliquots were removed periodically. An aliquot was taken at 3
minutes, then every 15 minutes until 135 minutes from the start, then every 30 minutes until 225
minutes from the start. Each aliquot was diluted with MeCN-d_3 (150 µL), and a 1H NMR
spectrum was acquired (128 scans at 25 °C, with acquisition starting 3 minutes after the aliquot
was taken from the reaction). The t_{1/2} was determined by examining the spectra to find the point
in time where the ratio of starting material (SM) and product was 1:1, based on 2 independent
resolved signals in the aromatic region. The t_{1/2} was found to be 75-90 min. Liquid
chromatography - mass spectrometry (LCMS) of the reaction mixture showed the oxazolidinone
III to be the main product. A small amount of SM remained along with a compound having a
minor NMR peak that may be attributed to the corresponding carbamate. A small amount (ca.
1%) of the monoethyl ester byproduct was also present as a contaminant from the BOC
deprotection step.

Table 4 below provides half-life data for some of the compounds described above.
The methods for determining the half-lives were approximately the same as described above,
with variations in procedure depending on such variables as solubility and reaction rates. The
cyclizations using the compounds of EXAMPLES 37, 38, and 47 were carried out in a mixed solvent (D₂O/l,4-dioxane-d₈ = 1:3) rather than a single solvent (D₂O).

**TABLE 4**

<table>
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<th>Example No</th>
<th>Half Life of Cyclization at 37 °C</th>
<th>pH of solution</th>
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<tr>
<td>35</td>
<td>75-90 minutes</td>
<td>7.52</td>
</tr>
<tr>
<td>36</td>
<td>135-150 minutes</td>
<td>7.52</td>
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<tr>
<td>37</td>
<td>~4 hours</td>
<td>7.68</td>
</tr>
<tr>
<td>47</td>
<td>9-10 hours</td>
<td>7.68</td>
</tr>
</tbody>
</table>

It can be seen from the half-life data that different structures have different half lives for cyclization. The half-life can thus be adjusted by a practitioner in the art by making structural changes in the Z group, thereby optimizing the rate of cyclization to maximize the amount of absorption and minimize the magnitude of the food effect.
WHAT IS CLAIMED IS:

1. A compound of formula I, or a pharmaceutically acceptable salt thereof:

\[
\begin{align*}
\text{(R_5)_{a,b}} & \\
\text{HN} & \\
\text{CO} & \\
\text{O} & \\
\text{(R_2)_{a,b}} & \\
\end{align*}
\]

wherein R1 is selected from H and C_{1-4}alkyl which is optionally substituted with 1-5 F groups;

Each R2 is independently selected from the group consisting of halogen, -CN, C_{1-4}alkyl, and -OC_{1-4}alkyl, wherein Cl-alkyl and -OCi-4alkyl are optionally substituted with 1-5 halogens;

R3 is selected from the group consisting of H, halogen, Ci-4alkyL and

-OC1_4alkyl, wherein Ci-4alkyl and -OCi_4alkyl are optionally substituted with 1-5 halogens;

R4 and R5 are each independently selected from the group consisting of halogen, Ci-4alkyl, and -0Ci-4alkyl, wherein Ci-4alkyl and -0Ci-4alkyl are optionally substituted with 1-5 halogens;

R6 is selected from H and C1-C5 alkyl optionally substituted with 1-5 halogens and optionally substituted with 1-2 phenyl groups, wherein phenyl is optionally substituted with 1-3 groups independently selected from halogen, C1-C3 alkyl, -OC1-C3 alkyl, CF3, and -OCF3;

R7 is selected from H and Q-C3 alkyl optionally substituted with 1-3 F;

X is selected from -OZ and -SZ wherein Z is selected from:

(a) C1-C5 alkyl which optionally includes an -O- atom between 2 adjacent carbon atoms, wherein Cj-C_{5} alkyl is optionally substituted with 1-5 halogens and is optionally substituted with 1-2 substituent groups independently selected from phenyl, -C(=O)OR, -OP(=O)(OR)_{2}, and -P(=O)(OR)_{2}, wherein phenyl is optionally substituted with 1-3 groups independently selected from halogen, -C(=O)OR, and Ci-C_{3}alkyl optionally substituted with 1-3 halogens; and

(b) phenyl, wherein phenyl is optionally substituted with 1-3 groups independently selected from halogen; Cs-C_{3}alkyl; -OCi-Csalkyl; -C(=O)OR; and C_{5} Cycloalkyl optionally substituted with 1-2 substituent groups independently selected from halogen, Ci-C_{3}alkyl, -OC_{r}C_{3}alkyl, CF_{3}, and -OCF_{3}; wherein d-C_{5}alkyl and -OC_{r}C_{5}alkyl are optionally
substituted with 1-5 F and are optionally substituted with 1-2 groups independently selected from
-C(K))OR 7, -N(R7)3, -OP(K))OR7)2, and -P(K))OR 7)2:

   a and b are integers independently selected from 0-4; and

c is an integer from 0-2.

2. The compound of Claim 1, wherein

   Z is selected from

   (a) C1-C5 alkyl which optionally includes an -O- atom between 2 adjacent
carbon atoms, wherein C1-C5 alkyl is optionally substituted with 1-3 F and is optionally
substituted with 1-2 substituent groups independently selected from phenyl, -C(K))ORo,
-OP(-O)(OR7)2, and -P(=O)(OR7)2, wherein phenyl is optionally substituted with 1-3 groups
independently selected from halogen, Ci-C3alkyl, CF3, and -C(K))OR 7; and

   (b) Phenyl, wherein phenyl is optionally substituted with 1-3 groups
independently selected from halogen; Q-Csalkyl; CF3; -OCj-C3alkyl; -OCF3; -C(K))OR 7; and
Cg-C6cycloalkyl which is optionally substituted with 1-2 groups independently selected from halogen, CH3, and -OCH3; wherein Ci-Csalkyl and -OCj-C3alkyl are optionally substituted
with 1-2 groups independently selected from -C(K))OR, -N(R7)2, -OP(K))OR7)2; and

   -P(K))OR 7)2.

3. The compound of Claim 2, wherein

   R1 is C1-2 alkyl, optionally substituted with 1-3 F;

   Each R2 is independently selected from -CN, C1-3 alkyl, CF3, -OCH3,
-OCF3, and F;

   R3 is selected from C1-3 alkyl, -OC3alkyl, and F, wherein Ci-3alkyl
and 0Ci-3alkyl are optionally substituted with 1-5 F;

   R4 and R5 are each independently selected from Ci-3alkyl, CF3, -OCH3,
-OCF3, and F;

   R6 is selected from H and Ci-Csalkyl, wherein C1-C2alkyl is optionally
substituted with one phenyl group, said phenyl being optionally substituted with 1-3 groups
independently selected from halogen, CH3, CF3, -OCH3, and -OCF3;

   R7 is selected from H and C1-C3 alkyl optionally substituted with 1-3 F;

   a is 1 or 2;

   b is an integer from 1-3; and

   c is 0 or 1.
4. The compound of Claim 3, wherein

X is selected from -SCi-C2alkyl and -OZ;
Z is selected from the group consisting of
(a) -(CH2CH2\theta)\text{-}nCi-C3alkyl, wherein Ci-C3alkyl is optionally substituted with 1-2 substituent groups independently selected from phenyl, -C(=O)OR6, -OP(-O)(OR7)2, and -P(=O)(OR7)2, wherein phenyl is optionally substituted with one group
-C(=O)OR7; and
(b) phenyl, which is optionally substituted with 1-3 substituents independently selected from C1-C4 alkyl, -OCi-C3alkyl, -C(=O)OR7, and cyclohexyl, wherein C1-C4 alkyl and -OCi-C3alkyl are optionally substituted with 1-2 groups independently selected from -N(R7)2, -C(=O)OR7, and -OP(=O)(OR7)2; and

n is an integer selected from 0 and 1.

5. The compound of Claim 4, wherein

R1 is Ci-2 alkyl;
R2 is CF3;
R3 is selected from CH3, CF3 and F;
Each R4 is independently selected from Cj-alkyl, -OCH3, and F;
R6 is selected from H, Ci-C2alkyl, and -CH2phenyl;
R7 is selected from H and Ci-C2alkyl;
a is 2;
b is 2 or 3; and
c is 0.

6. The compound of Claim 5, wherein

R1 is CH3; and
b is 3.

7. The compound of Claim 1 having formula IV, or a pharmaceutically acceptable salt thereof:
8. The compound of Claim 7, wherein \( Z \) is selected from the group consisting of:

(a) \( \text{Ci-C}_5 \text{alkyl} \) which optionally includes an \(-\text{O-}\) atom between 2 adjacent carbon atoms, wherein \( \text{Ci-Cs alkyl} \) is optionally substituted with 1-3 \( \text{F} \) and is optionally substituted with 1-2 substituent groups independently selected from phenyl, \(-\text{C(=O)OR} \), \(-\text{OP(=O)(OR)}\), wherein \( \text{phenyl} \) is optionally substituted with 1-3 groups independently selected from halogen, \( \text{Ci-C}_3 \text{alkyl} \), \( \text{CF}_3 \), and \(-\text{C(O)OR}\); and

(b) \( \text{Phenyl} \), wherein \( \text{phenyl} \) is optionally substituted with 1-3 groups independently selected from halogen; \( \text{Ci-Csalkyl} \); \( \text{CF}_3 \); \(-\text{O-Ci-C}_3 \text{alkyl} \); \(-\text{OCF}_3 \); \(-\text{C(O)OR}\), wherein \( \text{phenyl} \) is optionally substituted with one group \(-\text{C(=O)OR}\); and

\(-\text{P(=O)(OR)}\), wherein \( n \) is a non-negative integer selected from 0 and 1.

9. The compound of Claim 8, wherein

\( X \) is selected from \(-\text{SCi-C}_2 \text{alkyl} \) and \(-\text{OZ}\);

\( Z \) is selected from the group consisting of

(a) \(-\text{CH2CH2O-}\) \( \text{Ci-C}_3 \text{alkyl} \), wherein \( \text{Ci-C}_3 \text{alkyl} \) is optionally substituted with 1-2 substituent groups independently selected from phenyl, \(-\text{C(O)OR} \), \(-\text{OP(=O)(OR)}\), wherein \( \text{phenyl} \) is optionally substituted with one group \(-\text{C(=O)OR}\); and

(b) \( \text{phenyl} \), which is optionally substituted with 1-3 substituents independently selected from \( \text{C1-C4 alkyl} \), \(-\text{O-Ci-CSalkyl} \), \(-\text{CHD} \text{OR}\), and cyclohexyl, wherein \( \text{Ci-C}_4 \text{alkyl} \) and \(-\text{O-Ci-C}_3 \text{alkyl} \) are optionally substituted with 1-2 groups independently selected from \(-\text{N(R7)}\), \(-\text{C(=O)OR} \), \(-\text{OP(=O)(OR)}\), wherein \( n \) is an integer selected from 0 and 1; and
R6 is selected from the group consisting of H and C]-C2alkyl which is optionally substituted with one phenyl group, said phenyl being optionally substituted with 1-3 groups independently selected from halogen, CH3, CF3, -OCH3, and -OCF3.

10. The compound of Claim 9, wherein

X is selected from -SCi-C2alkyl and -OZ;
Z is selected from the group consisting of:
(a) -(CH2CH20-)nCi-C3alkyl, wherein C]-C3alkyl is optionally substituted with 1-2 substituent groups independently selected from phenyl, -C(=O)OR6, -0P(O)(OR7)2, and -P(-O)(OR7)2, wherein phenyl is optionally substituted with one group -C(=O)OR7; and
(b) phenyl, which is substituted with 1-3 substituents independently selected from C1-C4 alkyl, -OCi-C3alkyl, -C(O)OR7, and cyclohexyl, wherein Cj-C-jalkyl and -OCi-C3alkyl are optionally substituted with 1-2 groups independently selected from -N(R7)2, -C(=0)OR7, and -0P(O)(0R7)2;

R6 is selected from H, Cj-C^alkyl, and -CH2phenyl; and

R7 is selected from H and C]-C2alkyl.

11. The compound of Claim 10, wherein X is -OZ.

12. A pharmaceutical composition comprising the compound of Claim 1, or a pharmaceutically acceptable salt thereof, and a pharmaceutically acceptable carrier.

13. The compound of Claim 10, or a pharmaceutically acceptable salt thereof, wherein the compound has a structure which is selected from the group consisting of the following structures:
14. The compound of Claim 10, or a pharmaceutically acceptable salt thereof, wherein the compound has a structure which is selected from the group consisting of the following structures:
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</table>
15. A method of raising HDL-cholesterol in a patient in need of treatment, comprising the administration of the compound of Claim 1, or a pharmaceutically acceptable salt thereof to the patient.

16. A method of lowering LDL-cholesterol in a patient in need of treatment, comprising the administration of the compound of Claim 1, or a pharmaceutically acceptable salt thereof to the patient.

17. A method of treating hypercholesterolemia in a patient in need of treatment, comprising the administration of the compound of Claim 1, or a pharmaceutically acceptable salt thereof to the patient.

INTERNATIONAL SEARCH REPORT

PCT/US 09/57657

A CLASSIFICATION OF SUBJECT MATTER
IPC(8) - A01N 43/76, A61K 31/42 (2009.01)
USPC - 514/376
According to International Patent Classification (IPC) or to both national classification and IPC

B FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
USPC 514/376

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC 514/210 2, 514/340, 514/365, 546/209, 546/271 4, 548/204, 548/229 (text search-see search terms below)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PubWEST, Google Scholar, DialogWEB, SureChem, oxazolidinone, prodrug, precursor, cycliz5, in vivo, intramolecular cyclization

C DOCUMENTS CONSIDERED TO BE RELEVANT

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<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No</th>
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<td>US 2008/01 19476 A1 (Ali et al.) 22 May 2008 (22/05/2008) para [01 16]-[01 17], [0121]-[0123], [0128], [0130]-[0131], [0163]-[0166], [0172], [0214], Scheme 4</td>
<td>1-18</td>
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<td>Y</td>
<td>GOMES et al. Cyclization-activated Prodrugs Molecules, 2007, Vol 12, pp 2484-2506, pg 2486, para 1 to pg 2488, para 1, Scheme 2, Scheme 3, Scheme 4</td>
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<td>Y</td>
<td>SAARI et al. Cyclization-activated prodrugs Basic carbamates of 4-hydroxy isole J Med Chem, 1990, Vol 33, pp 97-101, pg 98, Scheme 1, Table 1, para 2, pg 99, para 8</td>
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D Further documents are listed in the continuation of Box C

* Special categories of cited documents
  "A" - document defining the general state of the art which is not considered to be of particular relevance
  "E" - earlier application or patent but published on or after the international filing date
  "L" - document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
  "O" - document referring to an oral disclosure, use, exhibition or other means
  "P" - document published prior to the international filing date but later than the priority date claimed

  "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
  "X" document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
  "Y" document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
  "G" document member of the same patent family

Date of the actual completion of the international search
06 November 2009 (06 11 2009)

Date of mailing of the international search report
13 NOV 2009

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PCT/DS/SP 571 272-7774

Form PCT/ISA/2 10 (second sheet) (April 2007)