Supplementary Materials

Figure S1. $^1$H-NMR spectrum of compound 5–A1.

Figure S2. $^{13}$C-NMR spectrum of compound 5–A1.
Figure S3. $^{31}$P-NMR spectrum of compound 5–A1.

Figure S4. HRMS spectrum of compound 5–A1.
Figure S5. HRMS spectrum of compound 5–A1.

Figure S6. $^1$H-NMR spectrum of compound 5-A2.
Figure S7. $^{13}$C-NMR spectrum of compound 5-A2.

Figure S8. $^{31}$P-NMR spectrum of compound 5-A2.
Figure S9. HRMS spectrum of compound 5-A2.

5-A2 [M+H] 489.1533621

Figure S10. HRMS spectrum of compound 5-A2.
Figure S11. $^1$H-NMR spectrum of compound 5-A3.

Figure S12. $^{13}$C-NMR spectrum of compound 5-A3.
Figure S13. $^{31}$P-NMR spectrum of compound 5-A3.

Figure S14. HRMS spectrum of compound 5-A3.
Figure S15. HRMS spectrum of compound 5-A3.

Figure S16. $^1$H-NMR spectrum of compound 5-A4.
Figure S17. $^{13}$C-NMR spectrum of compound 5-A4.

Figure S18. $^{31}$P-NMR spectrum of compound 5-A4.
Figure S19. HRMS spectrum of compound 5-A4.

5-A4 [M+H]382.152638

Figure S20. HRMS spectrum of compound 5-A4.
Figure S21. $^1$H-NMR spectrum of compound 5-A5.

Figure S22. $^{13}$C-NMR spectrum of compound 5-A5.
Figure S23. $^{31}$P-NMR spectrum of compound 5-A5.

Figure S24. HRMS spectrum of compound 5-A5.

5-A5 [M+H]462.1588621
Figure S25. HRMS spectrum of compound 5-A5.

5-A5 [M+H]462.158821

A5 #15-92 RT: 0.07-0.41 AV: 78 NL: 1.38E8
T: FTMS + p ESI Full ms [150.00-2000.00]

Figure S26. $^1$H-NMR spectrum of compound 5-A6.
Figure S27. $^{13}$C-NMR spectrum of compound 5-A6.

![13C-NMR spectrum of compound 5-A6](image)

Figure S28. $^{31}$P-NMR spectrum of compound 5-A6.

![$^{31}$P-NMR spectrum of compound 5-A6](image)
Figure S29. HRMS spectrum of compound 5-A6.

5-A6 [M+H]479.1245606

Figure S30. HRMS spectrum of compound 5-A6.
Figure S31. $^1$H-NMR spectrum of compound 5-A7.

Figure S32. $^{13}$C-NMR spectrum of compound 5-A7.
**Figure S33.** $^{31}$P-NMR spectrum of compound 5-A7.

**Figure S34.** HRMS spectrum of compound 5-A7.

5-A7 [M+H]$^{+}$474.1788486
Figure S35. HRMS spectrum of compound 5-A7.

Figure S36. \(^1\)H-NMR spectrum of compound 5-A8.
Figure S37. $^{13}$C-NMR spectrum of compound 5-A8.

Figure S38. $^{31}$P-NMR spectrum of compound 5-A8.
Figure S39. HRMS spectrum of compound 5-A8

5-A8 [M+H]534.138403

Figure S40. HRMS spectrum of compound 5-A8
Figure S41. $^1$H-NMR spectrum of compound 5-B1.

Figure S42. $^{13}$C-NMR spectrum of compound 5-B1.
Figure S43. $^{31}$P-NMR spectrum of compound 5-B1.

![NMR Spectrum](image)

Figure S44. HRMS spectrum of compound 5-B1.

![HRMS Spectrum](image)

5-B1 [M+H]$^{+}$440.1581131
Figure S45. HRMS spectrum of compound 5-B1.

**5-B1 [M+H]440.158131**

![HRMS spectrum](image)

Figure S46. $^1$H-NMR spectrum of compound 5-B2.
Figure S47. $^{13}$C-NMR spectrum of compound 5-B2.

Figure S48. $^{31}$P-NMR spectrum of compound 5-B2.
Figure S49. HRMS spectrum of compound 5-B2.

5-B2 [M+H] 485.1431913

Figure S50. HRMS spectrum of compound 5-B2.
Figure S51. $^1$H-NMR spectrum of compound 5-B3.

Figure S52. $^{13}$C-NMR spectrum of compound 5-B3.
Figure S53. $^{31}$P-NMR spectrum of compound 5-B3.

Figure S54. HRMS spectrum of compound 5-B3.
Figure S55. HRMS spectrum of compound 5-B3.

![HRMS spectrum of compound 5-B3](image)

Figure S56. $^1$H-NMR spectrum of compound 5-B4.

![$^1$H-NMR spectrum of compound 5-B4](image)
Figure S57. $^{13}$C-NMR spectrum of compound 5-B4.

Figure S58. $^{31}$P-NMR spectrum of compound 5-B4.
Figure S59. HRMS spectrum of compound 5-B4

5-B4 [M+H]378.1424631

Figure S60. HRMS spectrum of compound 5-B4.
Figure S61. ¹H-NMR spectrum of compound 5-B5.

Figure S62. ¹³C-NMR spectrum of compound 5-B5.
Figure S63. $^{31}$P-NMR spectrum of compound 5-B5.

Figure S64. HRMS spectrum of compound 5-B5.

5-B5 [M+H]458.1486913
Figure S65. HRMS spectrum of compound 5-B5.

Figure S66. $^1$H-NMR spectrum of compound 5-B6.
Figure S67. $^{13}$C-NMR spectrum of compound 5-B6.

Figure S68. $^{31}$P-NMR spectrum of compound 5-B6.
Figure S69. HRMS spectrum of compound 5-B6.

![HRMS spectrum of compound 5-B6](image1)

Figure S70. HRMS spectrum of compound 5-B6.

![HRMS spectrum of compound 5-B6](image2)
Figure S71. $^1$H-NMR spectrum of compound 5-B7.

Figure S72. $^{13}$C-NMR spectrum of compound 5-B7.
Figure S73. $^3$P-NMR spectrum of compound 5-B7.

Figure S74. HRMS spectrum of compound 5-B7.
Figure S75. HRMS spectrum of compound 5-B7.

5-B7 [M+H]470.168778

Figure S76. $^1$H-NMR spectrum of compound 5-B8.
Figure S77. $^{13}$C-NMR spectrum of compound 5-B8.

Figure S78. $^{31}$P-NMR spectrum of compound 5-B8.
Figure S79. HRMS spectrum of compound 5-B8.

Figure S80. $^1$H-NMR spectrum of compound 5-C1.
Figure S81. $^{13}$C-NMR spectrum of compound 5-C1.

Figure S82. $^{31}$P-NMR spectrum of compound 5-C1.
Figure S83. HRMS spectrum of compound 5-C1.

5-C1 [M+H]424.1995840

Figure S84. HRMS spectrum of compound 5-C1.

5-C1 [M+H]424.1995840
Figure S85. $^1$H-NMR spectrum of compound 5-C2.

Figure S86. $^{13}$C-NMR spectrum of compound 5-C2.
Figure S87. $^{31}$P-NMR spectrum of compound 5-C2.

![31P-NMR spectrum of compound 5-C2](image)

Figure S88. HRMS spectrum of compound 5-C2.

![HRMS spectrum of compound 5-C2](image)

5-C2 [M+H] 469.1846622
Figure S89. HRMS spectrum of compound 5-C2.

5-C2 [M+H] 469.1846622

Figure S90. 1H-NMR spectrum of compound 5-C3.
Figure S91. $^{13}$C-NMR spectrum of compound 5-C3.

Figure S92. $^{31}$P-NMR spectrum of compound 5-C3.
Figure S93. HRMS spectrum of compound 5-C3.

5-C3 [M+H]488.2308841

Figure S94. HRMS spectrum of compound 5-C3.
Figure S95. $^1$H-NMR spectrum of compound 5-C4.

Figure S96. $^{13}$C-NMR spectrum of compound 5-C4.
Figure S97. $^{31}$P-NMR spectrum of compound 5-C4.

![31P-NMR spectrum of compound 5-C4](image)

Figure S98. HRMS spectrum of compound 5-C4.

![HRMS spectrum of compound 5-C4](image)

5-C4 [M+H] 362.1839340
Figure S99. HRMS spectrum of compound 5-C4.

Figure S100. ¹H-NMR spectrum of compound 5-C5.
Figure S101. $^{13}$C-NMR spectrum of compound 5-C5.

Figure S102. $^{31}$P-NMR spectrum of compound 5-C5.
Figure S103. HRMS spectrum of compound 5-C5.

Figure S104. HRMS spectrum of compound 5-C5.
Figure S105. $^1$H-NMR spectrum of compound 5-C6.

Figure S106. $^{13}$C-NMR spectrum of compound 5-C6.
Figure S107. $^{31}$P-NMR spectrum of compound 5-C6.

31P NMR of JY-2013-11-14-C7

N
N
N P
O
OEt
O
O
OCH3

Figure S108. HRMS spectrum of compound 5-C6.

5-C6 [M+H] 454.2101487

C-6 #15-105 RT: 0.07-0.47 AV: 91 NL: 4.61E8
T: FTMS + p ESI Full ms [150.00-2000.00]

N
N
N P
O
OEt
O
O
OCH3
Figure S109. HRMS spectrum of compound 5-C6.

Figure S110. $^1$H-NMR spectrum of compound 5-C7.
Figure S111. $^{13}$C-NMR spectrum of compound 5-C7.

Figure S112. $^{31}$P-NMR spectrum of compound 5-C7.
Figure S113. HRMS spectrum of compound 5-C7.

5-C7 [M+H] 514.1697404

Figure S114. HRMS spectrum of compound 5-C7.
Figure S115. $^1$H-NMR spectrum of compound 5-D1.

Figure S116. $^{13}$C-NMR spectrum of compound 5-D1.
Figure S117. $^{31}$P-NMR spectrum of compound 5-D1.

Figure S118. HRMS spectrum of compound 5-D1.
Figure S119. HRMS spectrum of compound 5-D1.

Figure S120. $^1$H-NMR spectrum of compound 5-D2.
Figure S121. $^{13}$C-NMR spectrum of compound 5-D2.

Figure S122. $^{31}$P-NMR spectrum of compound 5-D2.
Figure S123. HRMS spectrum of compound 5-D2.

5-D2 [M+H] 461.0987397

Figure S124. HRMS spectrum of compound 5-D2.

5-D2 [M+H] 461.0987397
Figure S125. $^1$H-NMR spectrum of compound 5-D3.

Figure S126. $^{13}$C-NMR spectrum of compound 5-D3.
Figure S127. $^{31}$P-NMR spectrum of compound 5-D3.

Figure S128. HRMS spectrum of compound 5-D3.

5-D3 [M+H]480.1449616
Figure S129. HRMS spectrum of compound 5-D3.

Figure S130. $^1$H-NMR spectrum of compound 5-D4.
Figure S131. $^{13}$C-NMR spectrum of compound 5-D4.

![13C-NMR spectrum of compound 5-D4](image)

Figure S132. $^{31}$P-NMR spectrum of compound 5-D4.

![31P-NMR spectrum of compound 5-D4](image)
Figure S133. HRMS spectrum of compound 5-D4.

5-D4 [M+H]354.0980115

Figure S134. HRMS spectrum of compound 5-D4.

5-D4 [M+H]354.0980115
Figure S135. $^1$H-NMR spectrum of compound 5-D5.

Figure S136. $^{13}$C-NMR spectrum of compound 5-D5.
Figure S137. $^{31}$P-NMR spectrum of compound 5-D5.

![31P-NMR spectrum of compound 5-D5](image)

Figure S138. HRMS spectrum of compound 5-D5.

5-D5 [M+H] 434.1042397

![HRMS spectrum of compound 5-D5](image)
Figure S139. HRMS spectrum of compound 5-D5.

Figure S140. $^1$H-NMR spectrum of compound 5-D6.
Figure S141. $^{13}$C-NMR spectrum of compound 5-D6.

Figure S142. $^{31}$P-NMR spectrum of compound 5-D6.
Figure S143. HRMS spectrum of compound 5-D6.

Figure S144. HRMS spectrum of compound 5-D6.
Figure S145. $^1$H-NMR spectrum of compound 5-D7.

Figure S146. $^{13}$C-NMR spectrum of compound 5-D7.
Figure S147. $^{31}$P-NMR spectrum of compound 5-D7.

![Figure S147. $^{31}$P-NMR spectrum of compound 5-D7.](image)

Figure S148. HRMS spectrum of compound 5-D7.

5-D7 [M+H]506.0838179

![Figure S148. HRMS spectrum of compound 5-D7.](image)
Figure S149. HRMS spectrum of compound 5-D7.

5-D7 [M+H]506.083179