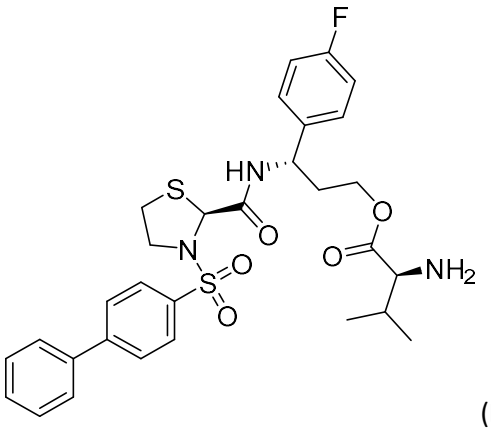
CLAIMS

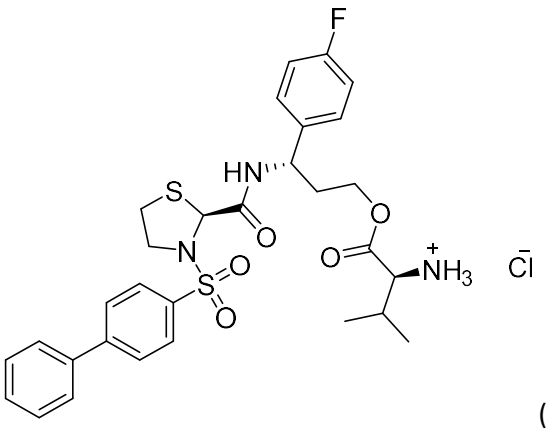
1. A pharmaceutical composition comprising a compound represented by formula (**I**)



(**I**)

or a pharmaceutically acceptable salt thereof wherein the pharmaceutical composition comprises one or more excipients, optionally wherein the compound has a purity of at least 90%.

2. The pharmaceutical composition~~compound~~ of claim 1, wherein said compound is represented by formula (**III**).



(**III**)

~~3. The compound of claim 1 or 2, wherein said compound binds human prostaglandin F2α receptor with an affinity of about 1 nM.~~

~~4. The compound of any one of claims 1-3, wherein said compound is soluble in aqueous solution at a concentration of from about 300 µg/mL to about 500 µg/mL.~~

~~5. The compound of claim 4, wherein said compound is soluble in aqueous solution at a concentration of about 380 µg/mL.~~

~~6. The compound of any one of claims 1-5, wherein said compound inhibits synthesis of inositol trisphosphate in a cell.~~

~~7. The compound of claim 6, wherein said cell is a mammalian cell.~~

~~8. The compound of claim 7, wherein said mammalian cell is a human cell.~~

~~9. The compound of claim 8, wherein said human cell is a myometrial cell.~~

~~10. The compound of claim 9, wherein said myometrial cell is a uterine myocyte.~~

~~11. The compound of any one of claims 1-10, wherein said compound induces a reduction in the amplitude of uterine contractions in a subject following administration of said compound to said subject.~~

~~12. The compound of claim 11, wherein said reduction is by from about 40% to about 50% relative to a measurement of the amplitude of uterine contractions in said subject recorded prior to said administration.~~

~~13. The compound of any one of claims 1-12, wherein said compound exhibits a half life in a subject of from about 1 hour to about 4 hours following administration of said compound to said subject.~~

~~14. The compound of any one of claims 1-13, wherein said compound reaches a maximum plasma concentration in a subject within from about 0.25 hours to about 2 hours following administration of said compound to said subject.~~

~~15. The compound of any one of claims 11-14, wherein said subject is a mammal.~~

~~16. The compound of claim 15, wherein said mammal is a human.~~

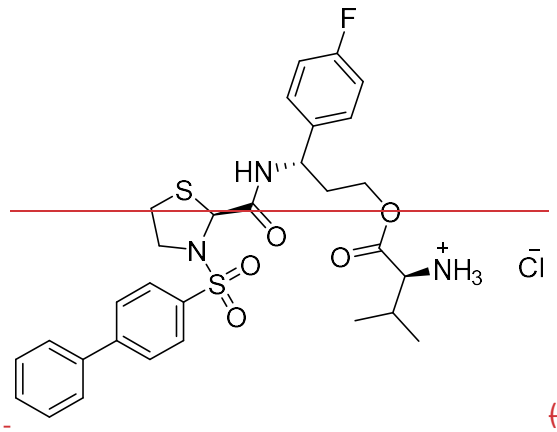
~~17. The compound of claim 15, wherein said mammal is a canine.~~

~~18. The compound of claim 15, wherein said mammal is a rat.~~

~~19. The compound of any one of claims 11-18, wherein said administration is oral.~~

~~20. The compound of any one of claims 11-18, wherein said administration is intravenous.~~

~~21.~~3. A pharmaceutical composition of claim 2,~~compound represented by formula (III)~~



~~(III)~~

wherein said compound is in a crystalline state.

~~22.~~4. The pharmaceutical composition~~compound~~ of claim ~~21~~3, wherein ~~said~~ the compound exhibits characteristic X-ray powder diffraction peaks at about 7.0° 2θ, about 8.1° 2θ, about 10.0° 2θ, about 12.0° 2θ, about 13.1° 2θ, about 14.1° 2θ, about 16.4° 2θ, about 18.4° 2θ, about 20.1° 2θ, about 21.0° 2θ, ~~and~~ about 23.5° 2θ, and about 29.5° 2θ.

~~23. The compound of claim 22, wherein said compound additionally exhibits X-ray powder diffraction peaks at about 12.0° 2θ, about 13.1° 2θ, about 14.1° 2θ, about 16.4° 2θ, about 18.4° 2θ, and about 29.5° 2θ.~~

~~24. The compound of any one of claims 21-23, wherein said compound is characterized by an X-ray powder diffraction spectrum substantially as depicted in any one of Figures 19, 22, 29, 45-49, and 54.~~

~~25. The compound of claim 24, wherein said compound is characterized by an X-ray powder diffraction spectrum substantially as depicted in Figure 49.~~

~~26.~~5. The pharmaceutical composition~~compound of any one~~ of claim~~s 21-25~~3, wherein ~~said~~ the compound exhibits ^{1}H nuclear magnetic resonance (NMR) peaks centered at about 1.1 ppm, about 3.3 ppm, about 4.9 ppm, about 5.4 ppm, about 7.1 ppm, about 7.7 ppm, about 7.9 ppm, and about 8.0 ppm.

~~27. The compound of any one of claims 21-26, wherein said compound is characterized by a ^{1}H NMR spectrum substantially as depicted in Figure 21.~~

~~28.~~6. The pharmaceutical composition~~compound of any one~~ of claim~~s 21-27~~3, wherein ~~said~~ the compound exhibits an endotherm at from about 145° C to about 147° C as measured by differential scanning calorimetry.

~~29. The compound of claim 28, wherein said compound exhibits an additional endotherm at about 214° C as measured by differential scanning calorimetry.~~

~~30. The compound of claim 29, wherein said compound is characterized by a differential scanning calorimetry curve substantially as depicted in Figure 30.~~

~~31. The compound of claim 28, wherein said compound exhibits an additional endotherm at about 228° C as measured by differential scanning calorimetry.~~

~~32. The compound of claim 31, wherein said compound is characterized by a differential scanning calorimetry curve substantially as depicted in Figure 33.~~

~~33.~~7. The pharmaceutical composition~~compound of any one~~ of claim~~s 21-32~~3, wherein ~~said~~ the compound exhibits a weight loss of from about 0.2% to about 0.6% when heated from 25° C to 100° C as measured by thermogravimetric analysis.

~~34. The compound of any one of claims 21-33, wherein said compound exhibits a weight loss of from about 2.5% to about 3.5% when heated from 100° C to 160° C as measured by thermogravimetric analysis.~~

~~35. The compound of any one of claims 21-34, wherein said compound exhibits a thermogravimetric analysis curve substantially as depicted in Figure 24.~~

~~36. A pharmaceutical composition comprising the compound of any one of claims 1-35.~~

~~37. The pharmaceutical composition of claim 36, wherein said pharmaceutical composition comprises one or more excipients.~~

~~38. The pharmaceutical composition of claim 36 or 37, wherein said compound has a purity of at least 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or 99.9%.~~

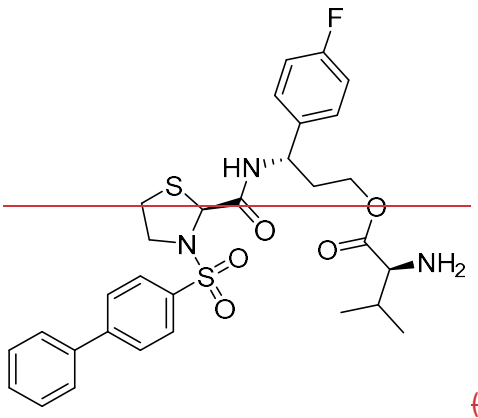
39. The pharmaceutical composition of claim 38, wherein said purity is ascertained by high pressure liquid chromatography (HPLC).

40. The pharmaceutical composition of any one of claims 36-39, wherein said compound or pharmaceutical composition is formulated for oral administration to a subject.

41. The pharmaceutical composition of any one of claims 36-40, wherein said compound or pharmaceutical composition is a tablet, capsule, gel cap, powder, liquid solution, or liquid suspension.

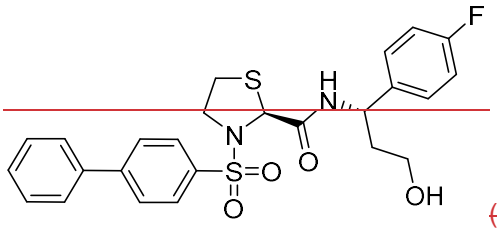
42. The pharmaceutical composition of any one of claims 36-39, wherein said compound or pharmaceutical composition is formulated for intravenous administration to a subject.

43. A method of synthesizing a compound represented by formula (**I**)



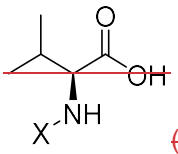
(**I**)

or a pharmaceutically acceptable salt thereof, said method comprising reacting a precursor represented by formula (**IV**)



(**IV**)

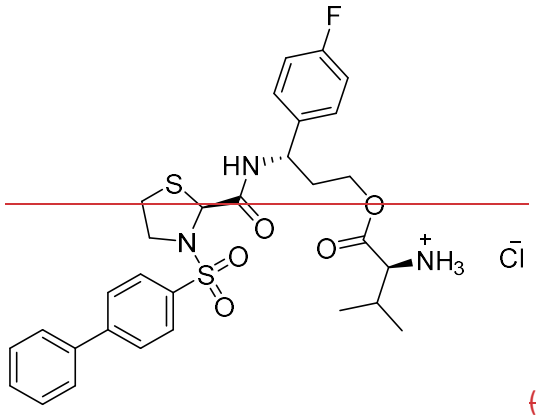
with a precursor represented by formula (**V**)



(V)

to form an amino ester, wherein X is a protecting group, and wherein said method further comprises deprotecting said amino ester.

44. The method of claim 43, wherein said compound is represented by formula (III).



(III)

45. The method of claim 43 or 44, said method comprising reacting said amino ester with a reagent capable of deprotecting said amino ester.

46. The method of any one of claims 43-45, wherein said protecting group is selected from the group consisting of *tert*-butoxycarbonyl, trityl, 4-monomethoxytrityl, 4-methyltrityl, 3,5-dimethoxyphenylisopropoxycarbonyl, 2-(4-biphenyl)isopropoxycarbonyl, 2-nitrophenylsulfenyl, 9-fluorenylmethoxycarbonyl, 2-(4-nitrophoneylsulfonyl)ethoxycarbonyl, (1,1-dioxobenzo[b]thiophene-2-yl)methoxycarbonyl, 1-(4,4-dimethyl-2,6-dioxocyclohex-1-ylidene)-3-methylbutyl, 2,7-di-*tert*-butyl-9-fluorenylmethoxycarbonyl, 2-fluoro-9-fluorenylmethoxycarbonyl, 2-monoisooctyl-9-fluorenylmethoxycarbonyl, 2,7-diisooctyl-9-fluorenylmethoxycarbonyl, tetrachlorophthaloyl, 2-[phenyl(methyl)sulfonio]ethyloxycarbonyl tetrafluoroborate, ethanesulfonylethoxycarbonyl, 2-(4-sulfophenylsulfonyl)ethoxycarbonyl, benzyloxycarbonyl, allyloxycarbonyl, *o*-nitrobenzenesulfonyl, 2,4-dinitrobenzenesulfonyl, benzothiazole-2-sulfonyl, 2,2,2-trichloroethyloxycarbonyl, dithiasuccinoyl, *p*-nitrobenzyloxycarbonyl, an α-azidoacid, propargyloxycarbonyl, 9-(4-bromophenyl)-9-fluorenyl, azidomethoxycarbonyl, hexafluoroacetone,

2-chlorobenzyloxycarbonyl, trifluoroacetyl, 2-(methylsulfonyl)ethoxycarbonyl, phenyldisulfanylethyloxycarbonyl, and 2-pyridyldisulfanylethyloxycarbonyl.

47. The method of claim 45 or 46, wherein said reagent is selected from the group consisting of methanesulfonic acid, hydrochloric acid, trifluoroacetic acid, acetic acid, piperidine, 1,8-diazabicyclo[5.4.0]undec-7-ene, morpholine, hexamethyleneimine, ammonia, diethylamine, piperazine, tris(2-aminoethyl)amine, hydrazine, 1-methylpyrrolidine, sodium hydrogen carbonate, sodium hydroxide, barium hydroxide, sodium carbonate, molecular hydrogen, hydrobromic acid, boron tribromide, tetrakis*(*triphenylphosphine*)*palladium, thiophenol, β-mercaptoethanol, 2-mercaptoacetic acid, aluminum amalgam, zinc, hypophosphorous acid, sodium borohydride, *N*-mercaptoacetamide, tin(II) chloride, trimethylphosphine, tributylphosphine, triphenylphosphine, benzyltriethylammonium tetrathiomolybdate, palladium(II) acetate, hydrofluoric acid, trimethylsilyl chloride, trimethylsilyl trifluoromethanesulfonate, and trifluoromethanesulfonic acid.

48. The method of claim 47, wherein said protecting group is *tert* butoxycarbonyl and wherein said reagent is selected from the group consisting of methanesulfonic acid, hydrochloric acid, and trifluoroacetic acid.

49. The method of claim 48, wherein said reagent is methanesulfonic acid.

50. The method of claim 43 or 44, said method comprising exposing said amino ester to electromagnetic radiation.

51. The method of any one of claims 43, 44, and 50, wherein said protecting group is selected from the group consisting of *o*-nitrobenzyloxycarbonyl, 4-nitroveratryloxycarbonyl, 2-(2-nitrophenyl)propyloxycarbonyl, and 2-(3,4-methylenedioxy-6-nitrophenyl)propyloxycarbonyl.

52. The method of claim 50 or 51, wherein said electromagnetic radiation is characterized by a wavelength of from about 300 nm to about 400 nm.

53. The method of any one of claims 43-52, said method comprising reacting said precursor represented by formula (**IV**) with said precursor represented by formula (**V**) and a diimide.

54. The method of claim 53, wherein said diimide is selected from the group consisting of 1-ethyl-3-(3-dimethylaminopropyl)carbodiimide and *N*,*N*'-diisopropylcarbodiimide.

55. The method of claim 54, wherein said diimide is 1-ethyl-3-(3-dimethylaminopropyl)carbodiimide.

56. The method of any one of claims 43-55, said method comprising reacting said precursor represented by formula (**IV**) with said precursor represented by formula (**V**) and a benzotriazole derivative.

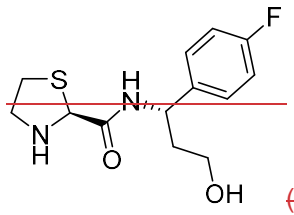
57. The method of claim 56, wherein said benzotriazole derivative is selected from the group consisting of 1-hydroxybenzotriazole, 6-chloro-1-hydroxybenzotriazole, and 1-hydroxy-7-azabenzotriazole.

58. The method of claim 57, wherein said benzotriazole derivative is 1-hydroxybenzotriazole.

59. The method of any one of claims 43-58, said method comprising reacting said precursor represented by formula (**IV**) with said precursor represented by formula (**V**) and a base.

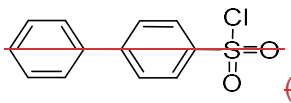
60. The method of claim 59, wherein said base is *N*,*N*-dimethylaminopyridine.

61. The method of any one of claims 43-60, said method comprising synthesizing said precursor represented by formula (**IV**) by reacting a precursor represented by formula (**VI**)



(**VI**)

with a precursor represented by formula (**VII**).



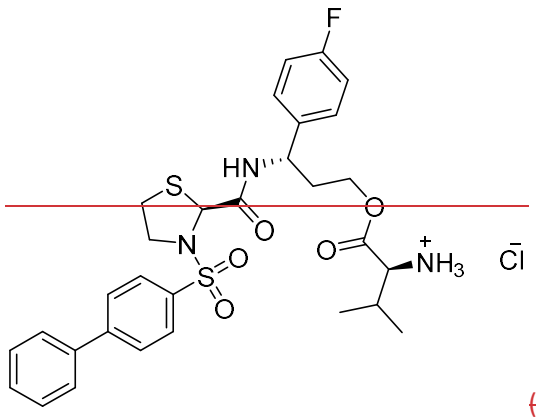
(**VII**)

62. The method of claim 61, said method comprising reacting said precursor represented by formula (**VI**) with said precursor represented by formula (**VII**) and one or more bases.

63. The method of claim 62, wherein said one or more bases are selected from the group consisting of diisopropylethylamine, triethylamine, and *N*,*N*-dimethylaminopyridine.

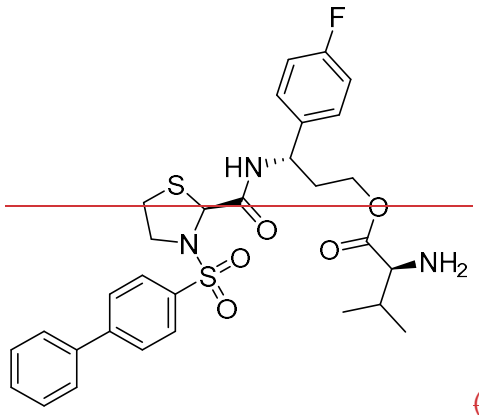
64. The method of claim 63, said method comprising reacting said precursor represented by formula (**VI**) with said precursor represented by formula (**VII**), diisopropylethylamine, and *N*,*N*-dimethylaminopyridine.

65. A method of making a compound represented by formula (**III**),



(**III**)

said method comprising mixing a compound represented by formula (**I**)



(**I**)

with hydrochloric acid.

~~66. The method of claim 65, wherein said hydrochloric acid is aqueous hydrochloric acid.~~

~~67. The method of claim 65 or 66, said method comprising making said compound represented by formula (III) in a crystalline state.~~

~~68. The method of any one of claims 65-67, said method comprising dissolving said compound represented by formula (I) in ethanol.~~

~~69. The method of any one of claims 65-68, said method comprising mixing said hydrochloric acid with ethanol.~~

~~70. The method of claim 69, said method further comprising mixing said hydrochloric acid with ethyl acetate.~~

~~71. The method of any one of claims 65-70, said method comprising adding said compound represented by formula (I) to said hydrochloric acid over a period of from about 20 minutes to about 30 minutes to form a mixture.~~

~~72. The method of claim 71, said method comprising maintaining the temperature of said mixture at from about 15° C to about 25° C during said adding.~~

~~73. The method of claim 72, said method comprising reducing the temperature of said mixture to about 5° C following said adding.~~

~~74. The method of claim 73, said method comprising stirring said mixture for from about 50 minutes to about 70 minutes at from about 0° C to about 5° C following said reducing.~~

~~75. The method of any one of claims 65-74, wherein said compound represented by formula (I) and said hydrochloric acid are mixed in equimolar amounts.~~

~~76. A compound produced by the method of any one of claims 43-75.~~

~~77.~~8. The pharmaceutical composition of any one of claims 1-7 for use in ~~A method of~~ treating or preventing preterm labor in a ~~subject~~human patient, ~~said method comprising administering to said subject~~wherein a therapeutically effective amount of the ~~compound of any one of claims 1-35 or the~~ pharmaceutical composition is to be administered to the patient~~of any one of claims 36-42~~.

~~78. A method of preventing labor prior to cesarean delivery in a subject, said method comprising administering to said subject a therapeutically effective amount of the compound of any one of claims 1-35 or the pharmaceutical composition of any one of claims 36-42.~~

~~79. A method of treating or preventing dysmenorrhea in a subject, said method comprising administering to said subject a therapeutically effective amount of the compound of any one of claims 1-35 or the pharmaceutical composition of any one of claims 36-42.~~

~~80.~~9. The pharmaceutical composition for use in accordance with ~~method of any one of~~ claim~~s 77-79~~8, wherein ~~said subject~~the patient is characterized by a gestational age of from about 24 weeks to about 34 weeks.

~~81.~~10. The pharmaceutical composition for use in accordance with ~~method of any one of~~ claim~~s 77-80~~8 or 9, wherein the ~~subject~~ patient exhibits a reduction in the amplitude of uterine contractions following ~~said administering~~use.

~~82. The method of claim 81, wherein said reduction is by from about 40% to about 50% relative to a measurement of the amplitude of uterine contractions in said subject recorded prior to said administering.~~

~~83. The method of any one of claims 77-82, wherein said compound exhibits a half life of from about 1 hour to about 4 hours in said subject.~~

~~84. The method of any one of claims 77-83, wherein said compound reaches a maximum plasma concentration in said subject within from about 0.25 hours to about 2 hours of said administering.~~

~~85. The method of any one of claims 77-84, wherein said subject is a mammal.~~

~~86. The method of claim 85, wherein said mammal is a human.~~

~~87. The method of any one of claims 77-86, said method comprising orally administering said compound or pharmaceutical composition to said subject.~~

~~88. The method of any one of claims 77-86, said method comprising intravenously administering said compound or pharmaceutical composition to said subject.~~

~~89. A kit comprising the compound of any one of claims 1-35 or the pharmaceutical composition of any one of claims 36-42 and a package insert.~~

~~90. The kit of claim 89, wherein said package insert instructs a user of said kit to administer said compound or pharmaceutical composition to a subject experiencing or at risk of undergoing preterm labor.~~

~~91. The kit of claim 90, wherein said subject is characterized by a gestational age of from about 24 weeks to about 34 weeks.~~

~~92. The kit of any one of claims 89-91, wherein said package insert instructs a user of said kit to mix said compound or pharmaceutical composition with an aqueous solution.~~

~~93. The kit of any one of claims 89-92, wherein said package insert instructs a user of said kit to orally administer said compound or pharmaceutical composition to said subject.~~

~~94. The kit of any one of claims 89-92, wherein said package insert instructs a user of said kit to intravenously administer said compound or pharmaceutical composition to said subject.~~