CLAIMS

~~1. An anti-aging composition comprising a combination of a first therapeutic agent that inhibits mitochondrial biogenesis and targets the large mitochondrial ribosome, a second therapeutic agent that inhibits mitochondrial biogenesis and targets the small mitochondrial ribosome, and a third therapeutic agent that induces mitochondrial oxidative stress.~~

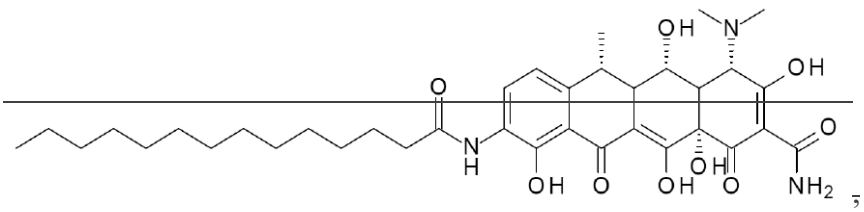
~~2. The anti-aging composition of claim 1, wherein the first therapeutic agent comprises azithromycin, the second therapeutic agent comprises doxycycline, and the third therapeutic agent comprises Vitamin C.~~

~~3. The anti-aging composition of claim 1, wherein the first therapeutic agent comprises an erythromycin family member conjugated with a first fatty acid, the second therapeutic agent comprises a tetracycline family member conjugated with a second fatty acid, and the third therapeutic agent comprises at least one of Vitamin C and ascorbyl palmitate.~~

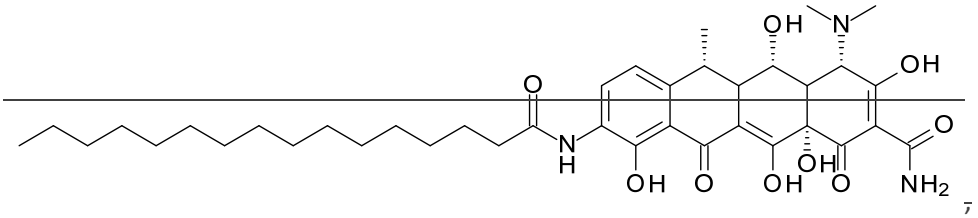
~~4. The anti-aging composition of claim 3, wherein at least one of the first fatty acid and the second fatty acid comprises myristic acid.~~

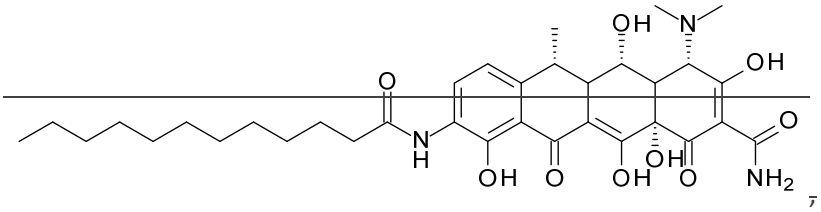
~~5. The anti-aging composition of claim 1, wherein at least one therapeutic agent comprises a conjugate with a fatty acid moiety.~~

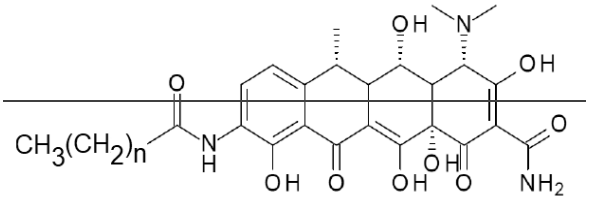
~~6. The anti-aging composition of claim 1, wherein the second therapeutic agent comprises one of:~~



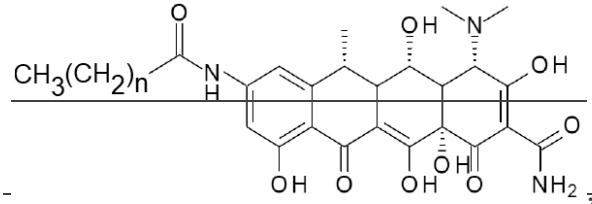
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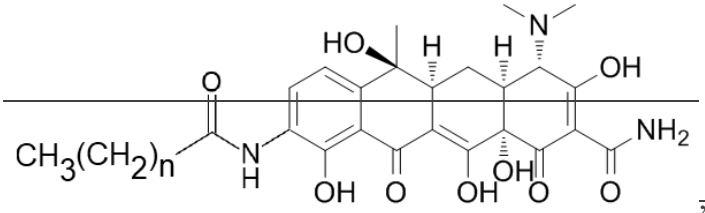




~~, wherein n is an integer from 1-20;~~



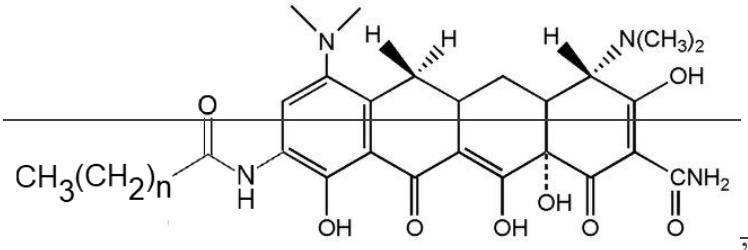
~~, wherein n is an integer from 1-20; and~~



~~, wherein n is an integer from 1-20.~~

~~7. The anti-aging composition of claim 1, wherein at least one of the first therapeutic agent and the second therapeutic agent comprises a conjugate with a TPP moiety.~~

~~8. The anti-aging composition of claim 1, wherein the second therapeutic agent comprises~~



~~, wherein n is an integer from 1-20.~~

~~9. The anti-aging composition of claim 2, wherein the concentration of at least one of azithromycin and doxycycline is sub-antimicrobial.~~

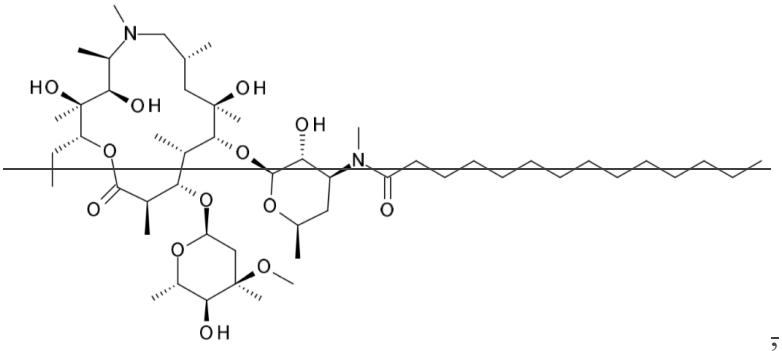
~~10. The anti-aging composition of claim 2, wherein the concentration of both azithromycin and doxycycline is sub-antimicrobial.~~

~~11. The anti-aging composition of claim 1, wherein the third therapeutic agent comprises Vitamin C administered orally at a concentration sufficient to achieve a peak Vitamin C concentration between 100 μM and 250 μM in at least one of blood, serum, and plasma.~~

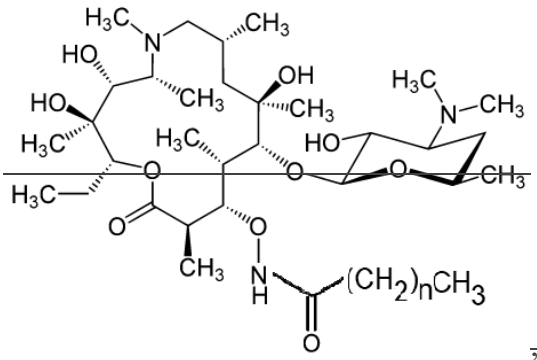
~~12. The anti-aging composition of claim 1, wherein the first therapeutic agent is a member of the erythromycin family or a conjugate of a member of the erythromycin family and a fatty acid.~~

~~13. The anti-aging composition of claim 1, wherein the second therapeutic agent is a member of the tetracycline family or a conjugate of a member of the doxycycline family and a fatty acid.~~

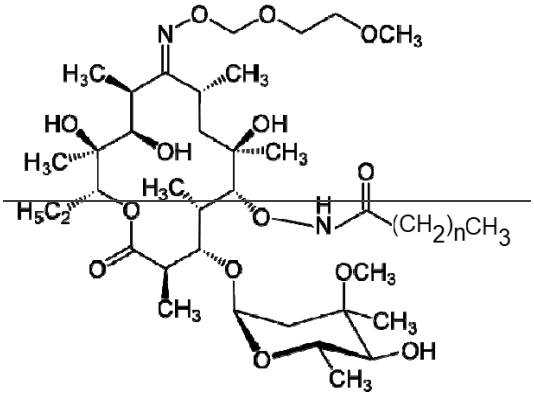
~~14. The anti-aging composition of claim 1, wherein the first therapeutic agent comprises one of:~~



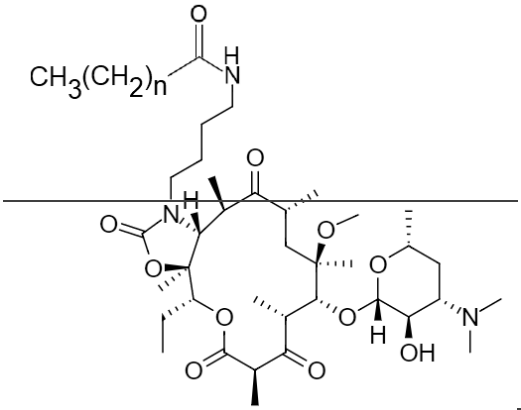
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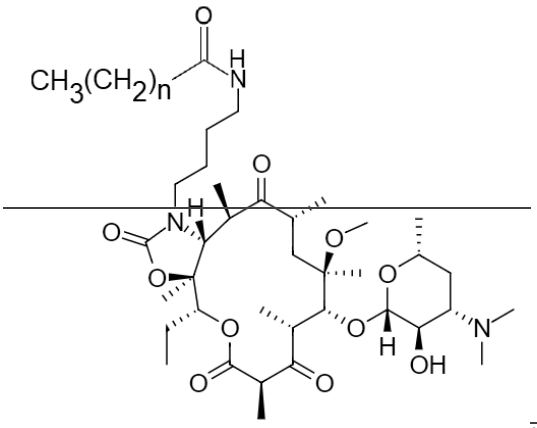
~~, wherein n is an integer from 1-20;~~



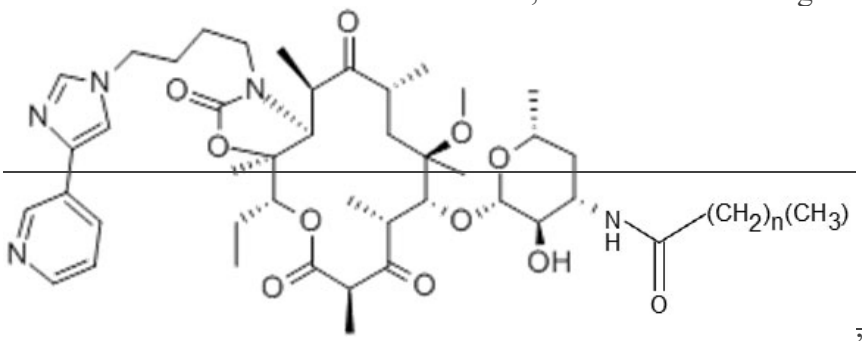
~~, wherein n is an integer from 1-20;~~



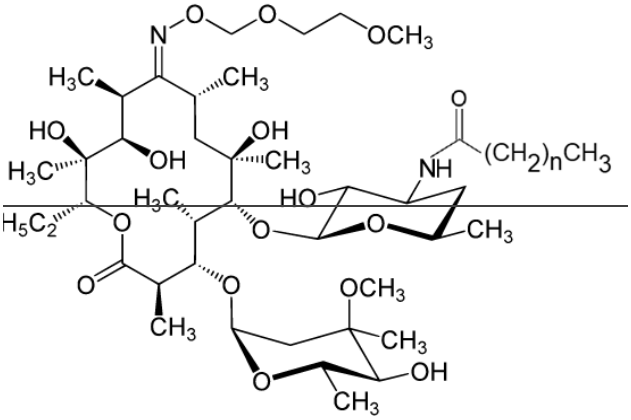
~~, wherein n is an integer from 1-20;~~



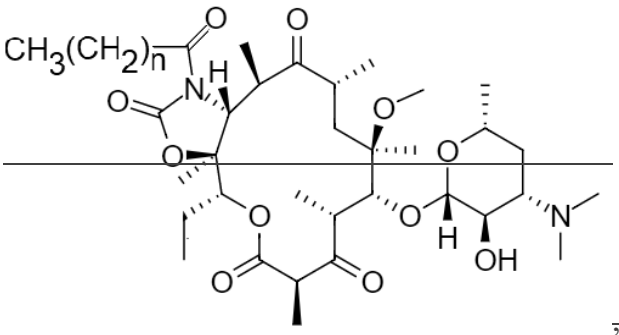
~~, wherein n is an integer from 1-20;~~



~~, wherein n is an integer from 1-20;~~

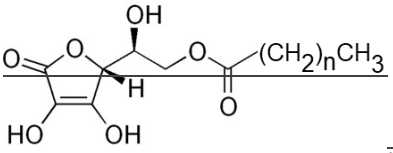


~~, wherein n is an integer from 1-20; and~~



~~, wherein n is an integer from 1-20.~~

~~15. The anti-aging composition of claim 1, wherein the third therapeutic agent is at least one of Vitamin C, ascorbyl palmitate, an ascorbate derivative, and~~



~~, wherein n is an integer from 1-20.~~

~~16. The anti-aging composition of claim 1, wherein the first therapeutic agent is a conjugate of azithromycin and myristic acid, the second therapeutic agent is a conjugate of doxycycline and myristic acid, and the third therapeutic agent is one of Vitamin C, ascorbyl palmitate, and an ascorbate derivative.~~

~~17. The anti-aging composition of claim 16, wherein the first therapeutic agent, the second therapeutic agent, and the third therapeutic agent are encapsulated in a liposomal drug delivery system.~~

~~18. The anti-aging composition of claim 1, wherein at least one therapeutic agent is chemically modified with at least one of TPP; a TPP-derivative; 2-butene-1,4-bis-TPP; 2-chlorobenzyl-TPP; 3-methylbenzyl-TPP; 2,4-dichlorobenzyl-TPP; 1-naphthylmethyl-TPP; p-xylylenebis-TPP; a derivative of 2-butene-1,4-bis-TPP; a derivative of 2-chlorobenzyl-TPP; a derivative of 3-methylbenzyl-TPP; a derivative of 2,4-dichlorobenzyl-TPP; a derivative of 1-~~

~~naphthylmethyl-TPP; a derivative of p-xylylenebis-TPP; guanidinium; a guanidinium derivative; quinolinium; a quinolinium-based moiety; a choline ester; rhodamine; a rhodamine derivative; pyridinium; (E)-4-(1H-Indol-3-ylvinyl)-N-methylpyridinium iodide (F16); a sulfonyl-urea derivative; diazoxide; and 10-N-nonyl acridine orange.~~

~~19. The anti-aging composition of claim 1, wherein the composition possesses anti-cancer activity and at least one of radiosensitizing activity and photosensitizing activity.~~

~~20. The anti-aging composition of claim 1, wherein the composition sensitizes cancer cells to at least one of chemotherapeutic agents, natural substances, and caloric restriction.~~

~~21. The anti-aging composition of claim 1, wherein the composition selectively kills senescent cells.~~

~~22. The anti-aging composition of claim 1, wherein the composition, prevents acquisition of a senescence-associated secretory phenotype.~~

~~23. The anti-aging composition of claim 1, wherein the composition, facilitates tissue repair and regeneration.~~

~~24. The anti-aging composition of claim 1, wherein the composition increases at least one of organismal life-span and health-span.~~

~~25. The anti-aging composition of claim 1, wherein the composition reduces one or more of hair loss, hearing loss, vision loss, memory loss, mental slowness, joint stiffness, muscle loss, strength loss, speed loss, balance loss, endurance loss, agility loss, sexual dysfunction, virility loss, testosterone reduction, lipofuscin deposits, and inflammation.~~

~~26. The anti-aging composition of claim 1, wherein the composition improves one or more of hair regeneration, hearing, vision, memory, mental acuity, joint mobility, muscle growth, muscular strength, muscular endurance, speed, balance, agility, and sexual performance.~~

~~27. The anti-aging composition of claim 1, wherein the composition at least one of restores hair growth, restores natural hair color, restores muscular coordination and gait, restores overall mobility, increases muscle mass, increases grip strength, increases concentration, increases mental clarity, and increases memory.~~

~~28. Use of: a first therapeutic agent that inhibits mitochondrial biogenesis and targets the large mitochondrial ribosome, a second therapeutic agent that inhibits mitochondrial biogenesis and targets the small mitochondrial ribosome, and a third therapeutic agent that induces mitochondrial oxidative stress, in the manufacture of a medicament for treating the effects of aging.~~

1. Use of: a first therapeutic agent that inhibits mitochondrial biogenesis and targets the large mitochondrial ribosome, a second therapeutic agent that inhibits mitochondrial biogenesis and targets the small mitochondrial ribosome, and a third therapeutic agent that induces mitochondrial oxidative stress, in the manufacture of a medicament for reducing one or more of hair loss, hearing loss, vision loss, memory loss, mental slowness, joint stiffness, muscle loss, strength loss, speed loss, balance loss, endurance loss, agility loss, sexual dysfunction, virility loss, testosterone reduction, lipofuscin deposits, and inflammation, wherein the first therapeutic agent is selected from the macrolide family, the ketolide family, the amphenicol family, the lincosamide family, the pleuromutilin family, derivatives thereof, and combinations thereof, wherein the second therapeutic agent is selected from the tetracycline family, the glycylcycline family, the fluorocycline family, the aminoglycoside family, the oxazolidinone family, derivatives thereof,

and combinations thereof, and wherein the third therapeutic agent is selected from Vitamin C and an ascorbate derivative.

2. Use of: a first therapeutic agent that inhibits mitochondrial biogenesis and targets the large mitochondrial ribosome, a second therapeutic agent that inhibits mitochondrial biogenesis and targets the small mitochondrial ribosome, and a third therapeutic agent that induces mitochondrial oxidative stress, in the manufacture of a medicament for improving one or more of hair regeneration, hearing, vision, memory, mental acuity, joint mobility, muscle growth, muscular strength, muscular endurance, speed, balance, agility, and sexual performance, wherein the first therapeutic agent is selected from the macrolide family, the ketolide family, the amphenicol family, the lincosamide family, the pleuromutilin family, derivatives thereof, and combinations thereof, wherein the second therapeutic agent is selected from the tetracycline family, the glycylcycline family, the fluorocycline family, the aminoglycoside family, the oxazolidinone family, derivatives thereof, and combinations thereof, and wherein the third therapeutic agent is selected from Vitamin C and an ascorbate derivative.

3. Use of: a first therapeutic agent that inhibits mitochondrial biogenesis and targets the large mitochondrial ribosome, a second therapeutic agent that inhibits mitochondrial biogenesis and targets the small mitochondrial ribosome, and a third therapeutic agent that induces mitochondrial oxidative stress, in the manufacture of a medicament for restoring hair growth, restores natural hair color, restores muscular coordination and gait, restores overall mobility, increases muscle mass, increases grip strength, increases concentration, increases mental clarity, and increases memory, wherein the first therapeutic agent is selected from the macrolide family, the ketolide family, the amphenicol family, the lincosamide family, the pleuromutilin family,

derivatives thereof, and combinations thereof, wherein the second therapeutic agent is selected from the tetracycline family, the glycylcycline family, the fluorocycline family, the aminoglycoside family, the oxazolidinone family, derivatives thereof, and combinations thereof, and wherein the third therapeutic agent is selected from Vitamin C and an ascorbate derivative.

~~29.~~4. The use of any of claims ~~28~~1-3, wherein the first therapeutic agent comprises azithromycin, the second therapeutic agent comprises doxycycline, and the third therapeutic agent is Vitamin C.

~~30.~~5. The use of any of claims ~~28~~1-3, wherein the first therapeutic agent comprises an erythromycin family member conjugated with a first fatty acid, and the second therapeutic agent comprises a tetracycline family member conjugated with a second fatty acid.

~~31.~~6. The use of claim ~~30~~5, wherein at least one of the first fatty acid and the second fatty acid comprises myristic acid.

~~32.~~7. The use of any of claims ~~28~~1-3, wherein the first therapeutic agent comprises a compound of claim 14.

~~33.~~8. The use of any of claims ~~28~~1-3, wherein the first therapeutic agent comprises an azithromycin and myristic acid conjugate, and the second therapeutic agent comprises a doxycycline and myristic acid conjugate.

~~34.~~9. The use of any of claims ~~28~~1-3, wherein at least one therapeutic agent comprises a conjugate with a tri-phenyl-phosphonium (TPP) moiety.

~~35.~~10. The use of any of claims ~~28~~1-3, wherein mitochondrial oxidative stress in cancer cells is induced by one of radiation therapy, and a third therapeutic agent comprising at least one of Vitamin C and ascorbyl palmitate.

~~36.~~11. The use of claim ~~29~~4, wherein the concentration of at least one of azithromycin and doxycycline is sub-antimicrobial, and the third therapeutic agent is Vitamin C at a concentration sufficient to achieve a peak Vitamin C concentration between 100 μM and 250 μM in at least one of blood, plasma, and serum.

~~37.~~12. The use of claim ~~29~~4, wherein the medicament is suitable for administering 250 mg of azithromycin twice per week, 100 mg of doxycycline twice per day, and 500 mg of Vitamin C 500 mg once per day.

~~38.~~13. The use of any of claims ~~2~~81-3, wherein the third therapeutic agent is one of Vitamin C, an ascorbate derivative, a chemotherapeutic, and radiation.

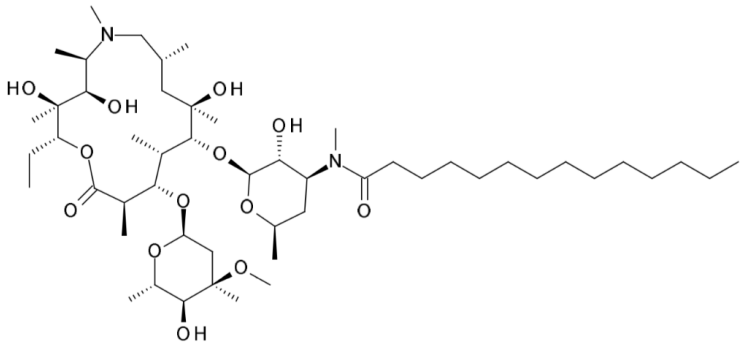
~~39.~~14. The use of any of claims ~~2~~81-3, wherein at least one therapeutic agent is chemically modified with one of a membrane-targeting signal and a mitochondria-targeting signal.

~~40.~~15. The use of any of claims ~~2~~81-3, wherein the first therapeutic agent comprises a conjugate of azithromycin and a first fatty acid, the second therapeutic agent comprises a conjugate of doxycycline and a second fatty acid, and the third therapeutic agent comprises at least one of Vitamin C, ascorbyl palmitate, and an ascorbate derivative.

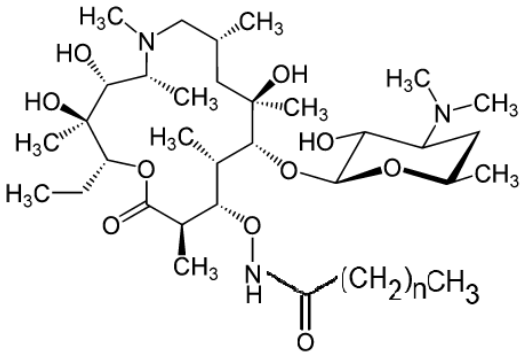
~~41.~~16. The use of claim ~~40~~15, wherein at least one of the first fatty acid and the second fatty acid is myristic acid.

~~42.~~17. An anti-senescence pharmaceutical composition comprising the combination of a first therapeutic agent selected from azithromycin and a conjugate of azithromycin and a first fatty acid, a second therapeutic agent selected from doxycycline and a conjugate of doxycycline and a second fatty acid, and a third therapeutic agent selected from Vitamin C, ascorbyl palmitate, and an ascorbate derivative.

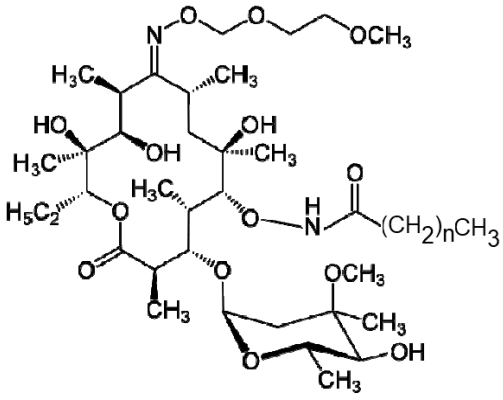
43.18. The pharmaceutical composition of claim 4217, wherein the first therapeutic agent is a conjugate of azithromycin and a first fatty acid selected from the group consisting of:



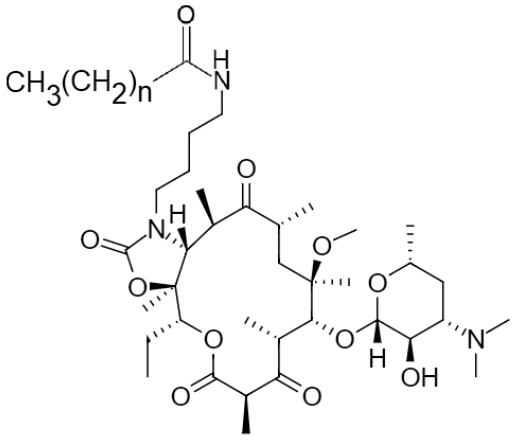
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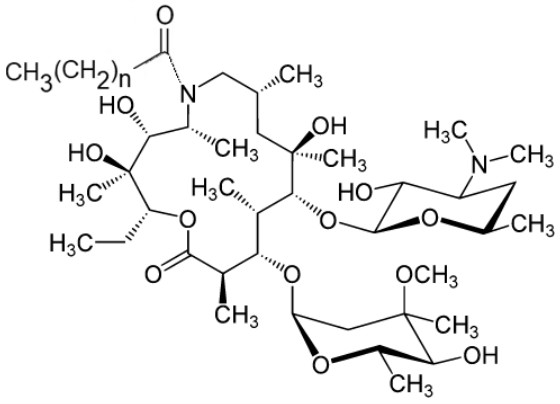
, wherein n is an integer from 1-20;



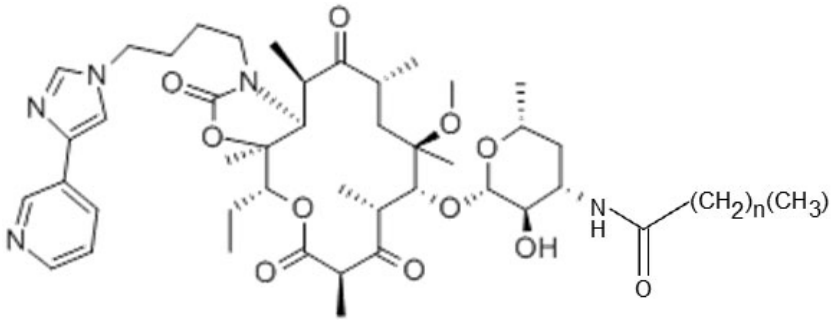
, wherein n is an integer from 1-20;



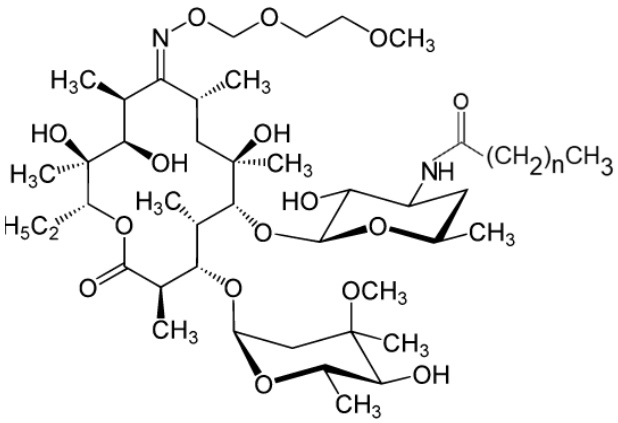
, wherein n is an integer from 1-20;



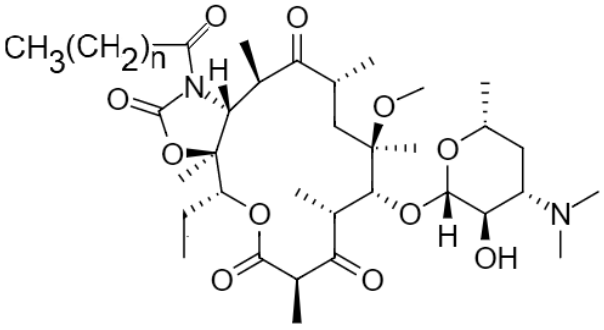
, wherein n is an integer from 1-20;



, wherein n is an integer from 1-20;

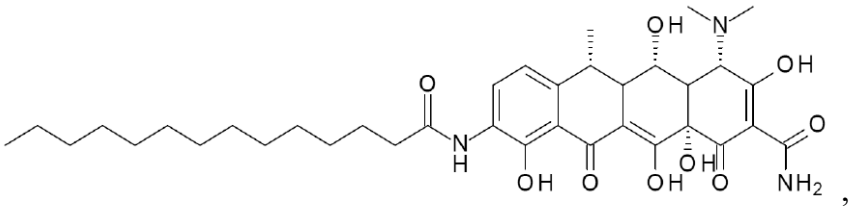


, wherein n is an integer from 1-20; and

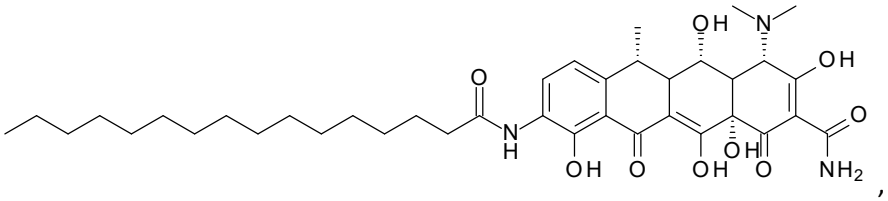


, wherein n is an integer from 1-20

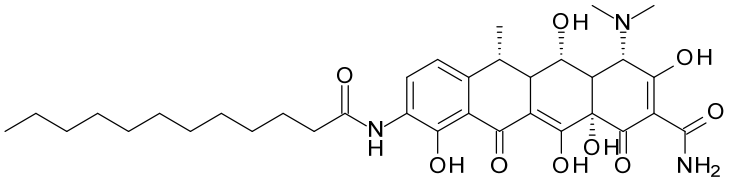
~~44.~~19. The pharmaceutical composition of claim ~~42~~17, wherein the second therapeutic agent is a conjugate of doxycycline and a second fatty acid selected from the group consisting of:



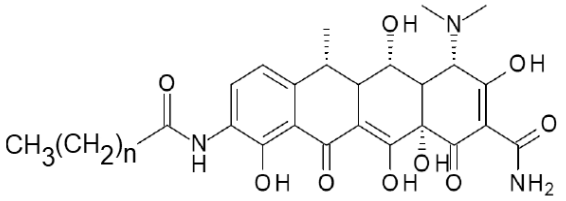
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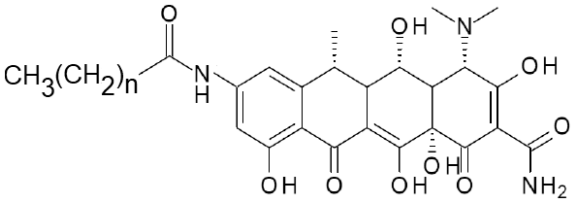
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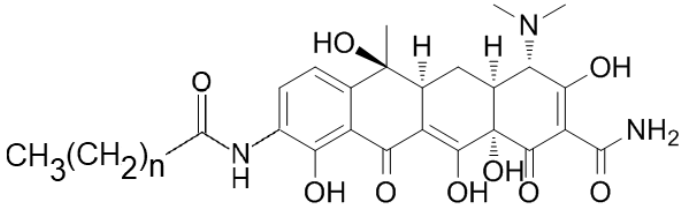
,



, wherein n is an integer from 1-20;



, wherein n is an integer from 1-20; and



, wherein n is an integer from 1-20.

~~45. Use of:~~

~~a first therapeutic agent that targets the large mitochondrial ribosome for inhibiting mitochondrial biogenesis,~~

~~a second therapeutic agent that targets the small mitochondrial ribosome for inhibiting mitochondrial biogenesis, and~~

~~a third therapeutic agent for inducing mitochondrial oxidative stress,~~

~~in the manufacture of a medicament for preventing or delaying the onset of senescence.~~

~~46. The use of claim 45, wherein the first therapeutic agent is a compound of claim 14, the second therapeutic agent is one of doxycycline and a conjugate of doxycycline and a second fatty acid, and the third therapeutic agent is one of Vitamin C, ascorbyl palmitate, and an ascorbate derivative.~~