Description

The present invention is concerned with the use of 17β-N-monosubstituted-carbamoyl-4-aza-5α-androst-1-en-3-one compounds as testosterone-5α-reductase inhibitors for the preparation of a medicament for the treatment of androgenic alopecia, including male pattern alopecia.

It is well known in the art that certain undesirable physiological manifestations, such as acne vulgaris, seborrhea, female hirsutism, male pattern baldness and benign prostatic hypertrophy, are the result of hyperandrogenic stimulation caused by an excessive accumulation of testosterone or similar androgenic hormones in the metabolic system. Early attempts to provide a chemotherapeutic agent to counter the undesirable results of hyperandrogenicity resulted in the discovery of several steroidal antiandrogens having undesirable hormonal activities of their own. The estrogens, for example, not only counteract the effect of the androgens but have a feminizing effect as well. Non-steroidal anti-androgens have also been developed, for example, 4′-nitro-3′-trifluoromethylisobutyranilide. See Neri et al., Endo., Vol. 91, No. 2 (1972). However, these products, though devoid of hormonal effects, are peripherally active, competing with the natural androgens for receptor sites, and hence have a tendency to feminize a male host or the male fetus of a female host.

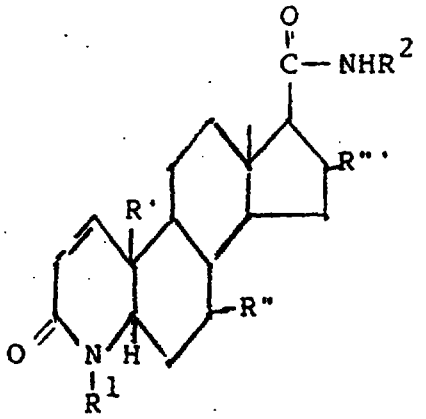
It more recently became known in the art that the principal mediator of androgenic activity in some target organs is 5α-dihydrotestosterone, and that it is formed locally in the target organ by the action of testosterone-5α-reductase. It therefore has been postulated and demonstrated that inhibitors of testosterone-5α-reductase will serve to prevent or lessen symptoms of hyperandrogenic stimulation. Nayfe et al., Steroids, 14, 269 (1969) demonstrated in vitro that methyl 4-androsten-3-one-17β-carboxylate was a testosterone-5α-reductase inhibitor. Then Voigt and Hsia, Endocrinology, 92, 1216 (1973), Canadian Pat. No. 970,692, demonstrated that the above ester and the parent free acid, 4-androsten-3-one-17β-carboxylic acid are both active inhibitors of testosterone-5α-reductase in vitro. They further demonstrated that topical application of either testosterone or 5α-dihydrotestosterone caused enlargement of the female hamster flank organ, an androgen dependent sebaceous structure. However, concomitant administration of 4-androsten-3-one-17β-carboxylic acid or its methyl ester inhibited the response elicited by testosterone but did not inhibit the response elicited by 5α-dihydrotestosterone. These results were interpreted as indicating that the compounds were antiandrogenic by virtue of their ability to inhibit testosterone-5α-reductase.

A number of 4-aza steroid compounds are known. See, for example, U.S. Pat. Nos. 2,227,876; 3,239,417; 3,264,301; and 3,285,918; French Pat. No. 1,465,544; Doorenbos and Solomons, J. Pharm. Sci. 62, 4, pp. 638-640 (1973); Doorenbos and Brown, J. Pharm. Sci., 60 8, pp. 1234-1235 (1971); and Doorenbos and Kim, J. Pharm. Sci . 63, 4, pp. 620-622 (1974).

In addition U.S. Patent 4,377,584 and 4,220,775 of Rasmusson et al. describe a group of 4-aza-17β-substituted-5α-androstan-3-ones which are said to be useful in the treatment of hyperandrogenic conditions. However, none of the cited references suggest that any of the 17βN-(monosubstituted) carbamoyl-4-aza-5α-androst-1-en-3-ones of the present invention would have utility as highly potent testosterone-5α-reductase inhibitors.

EP-A-4949 discloses a large group of azasteroids as testosterone 5α-reductase inhibitors and their use in a variety of diseases, including male pattern baldness. J. Med. Chem vol. 29 p. 2298-2315, 1986 and Endocrinology vol 117(2), p. 571-579, 1985, disclose the effect of two compounds of the present application on 5α-reductase and discuss the possible use in conditions where 5α-dihydrotestosterone was implicated. No proof that androgenic alopecia has or could be treated was given.

The present invention is concerned with compounds of the formula:



I

wherein R^1 is hydrogen, methyl or ethyl.

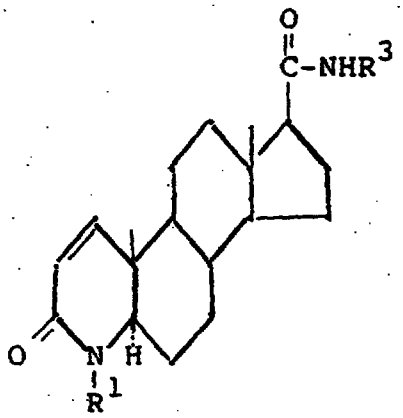
R^2 is a hydrocarbon radical selected from straight and branched chain alkyl of from 1-12 carbons or monocyclic aryl optionally containing 1 or more lower alkyl substituents of from 1-2 carbon atoms and/or 1 or more halogen (Cl, F or Br) substituents.

R' is hydrogen or methyl.

R" is hydrogen or β-methyl.

R"' is hydrogen, α-methyl or β-methyl.

A preferred embodiment of the novel compounds of our invention is represented by the formula:



wherein R^1 is hydrogen, methyl or ethyl, and R^3 is branched chain alkyl of from 4-8 carbons.

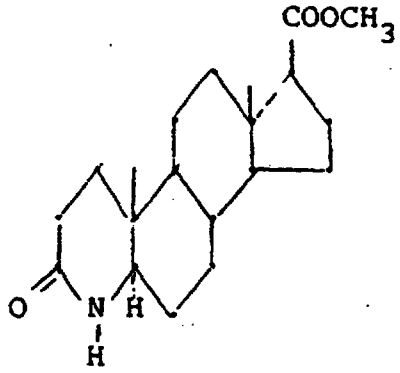
Representative compounds of the present invention include the following:

17β-(N-tertbutylcarbomoyl)-4-aza-4-methyl-5-α-androst-1-en-3-one,
17β-(N-isobutylcarbamoyl)-4-aza-4-methyl-5-α-androst-1-en-3-one,
17β-(N-tert-octylcarbomoyl)-4-aza-4-methyl-5α-androst-1-en-3-one,
17β-(N-octylcarbamoyl)-4-aza-4-methyl-5α-androst-1-en-3-one,
17β-(n-1,1-diethylbutylcarbamoyl)-4-aza-4-methyl-5-α-androst-1-en-3-one,
17β-(N-neopentylcarbamoyl)-4-aza-4-methyl-5α-androst-1-en-3-one,
17β-(N-tert-amylcarbamoyl-4-aza-4-methyl-5α-androst-1-en-3-one,
17β-(N-tert-hexylcarbamoyl)-4-aza-4-methyl-5α-androst-1-en-3-one.

and the corresponding compounds wherein the 4-methyl substituent is replaced in each of the above named compounds by a hydrogen or an ethyl radical.

Also included as representative compounds are any of the above indicated compounds having the N-branched chain alkyl substituent replaced by a methyl, ethyl, propyl, i-propyl, butyl, phenyl; 2, 3 or 4 tolyl, xylyl, 2-bromo or 2-chlorophenyl, 2-6-dichloro, or a 2, 6-dibromephenyl substituent.

The compounds of formula I of the present invention are prepared by a method starting with the known steroid ester of the formula:



II

17β-(carbomethoxy)-4-aza-5-α-androstan-3-one which includes the stages of 1) dehydrogenating said starting material to produce the corresponding compound containing a double-bond in the 1,2-position of the A-ring, 2) converting the 17-carbomethoxy substituent into a N-monosubstituted carbomyl substituent and, if desired, 3) alkylating the A-ring nitrogen to introduce a N-methyl or 4-ethyl substituent into the A ring. In carrying out the process of the present invention, it is essential that Stage 1 dehydrogenation of the 1,2-position of the steroid A ring be carried out using a 4-aza-5α-androstan-3-one-compound having no substituent other than hydrogen attached to the A-ring nitrogen. Stage 2 may consist of one or more chemical steps and if desired may take place before stage (1) or following stage (1) or stage (3).

The products of our invention are formed by 1) heating a 17β-alkoxycarbonyl-4-aza-5α-androstan-3-one compound III with a dehydrogenating agent such as benzeneseleninic anhydride in refluxing chlorobenzene to form a 17β-alkoxycarbonyl-4-aza-5α-androst-1-en-3-one IV, 2) the formed 5α-androst-1-en-3-one compound from Step 1 is reacted with sodium hydride under anhydrous conditions in a neutral solvent such as dimethylformamide, 3) contacting the resulting reaction mixture with an alkyl (methyl or ethyl) iodide to form the corresponding 17-β-alkoxy-carbamoyl-4-alkyl-4-aza-5α-androst-1-en-3-one V, 4) subsequently hydrolyzing said 17β-alkoxycarbonyl-4-alkyl-4-aza-5α-androst-1-en-3-one with a strong base such as aqueous methanolic potassium hydroxide at the reflux temperature, followed by acidification and isolation of the resulting steroidal acid, 17β-carboxy 4-alkyl-4-aza-5α-androst-1-en-3-one VI, 5) said steroidal acid is then converted to its corresponding 2-pyridylthio ester by refluxing with triphenyl phosphine and 2,2′-dipridyl disulfide in an inert solvent such as toluene and the resulting product 17β-(2-pyridylthiocarbonyl)-4-alkyl-4-aza-5α-androst-1-en-3-one VII is isolated by chromatography on silica gel, 6) said pyridylthio ester is then reacted with ethyl amine in tetrahydrofuran to form the desired products 17β-N-ethylcarbamoyl-4-alkyl-4-aza-5α-androst-1-en-3-one VIII which is isolated by chromatography on silica gel. When the previous reaction is carried out using an amine of formula R^2NH in place of ethyl amine, the corresponding 17β-(N-R^2-carbamoyl)-4-alkyl-4-aza-5α-androst-1-en-3-one is prepared.

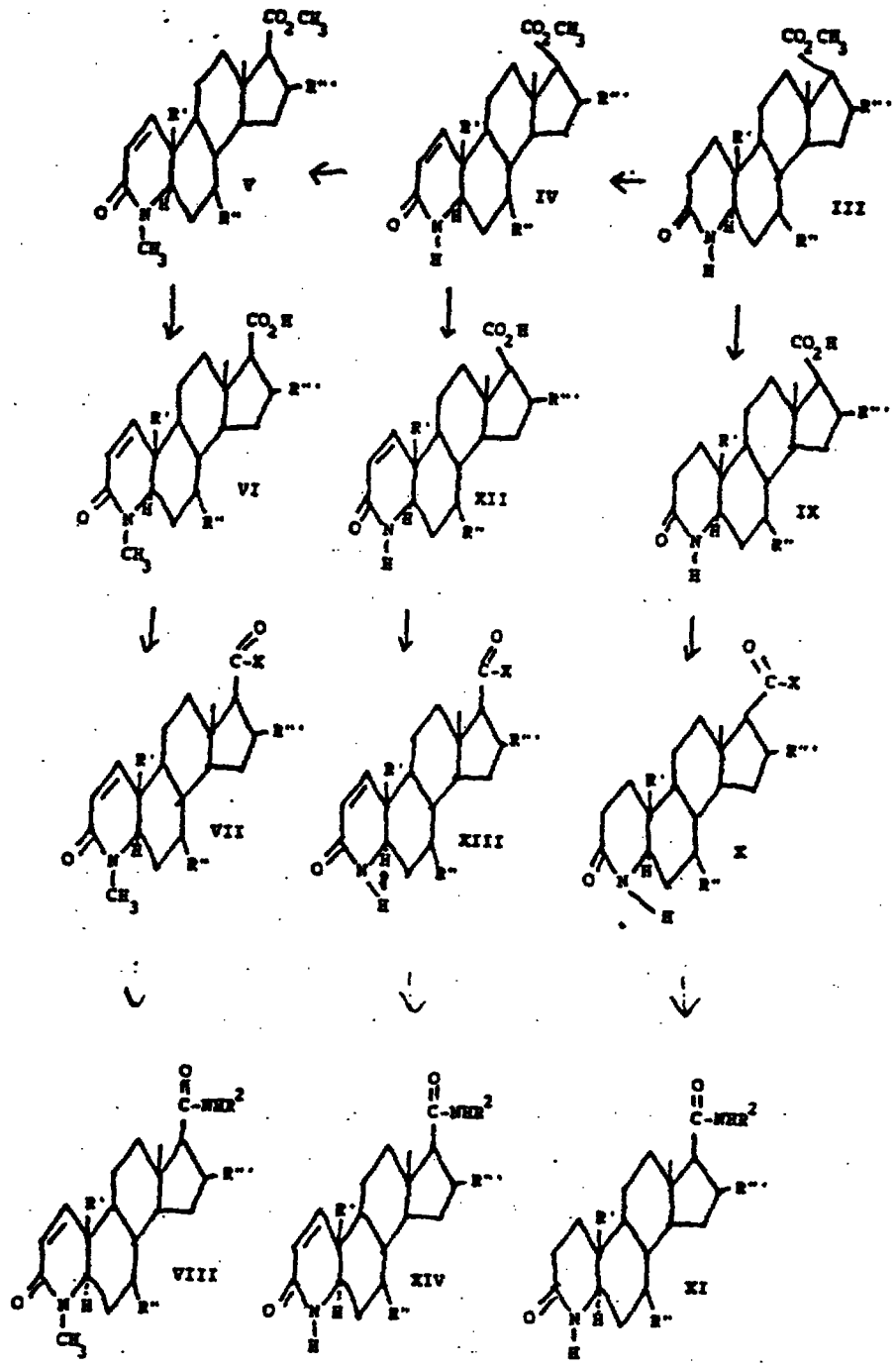
The corresponding 17β(N-R^2-carbamoyl)-4-aza-5α-androst-1-en-3-one XIV is readily prepared from the 17β (alkoxycarbonyl)-4-aza-5α-androst-1-en-3-one IV by repeating the above series of reaction steps but omitting Step 2 herein above i.e. treatment of the 4-aza-5-α-androst-1-en-3-one with sodium amide followed by methyl or ethyl iodide via intermediates XII and XIII.

Preparing the compounds of our invention having only hydrogen as the sole substituent on the ring A - nitrogen, the double bond in the A ring is introduced as the last step of the process. Thus, a 17β-alkoxycarbonyl 4-aza-5α-androstan-3-one III is hydrolyzed to the corresponding steroidal acid IX 17β-carboxy-4-aza-5α-androstan-3-one which in turn is converted to the corresponding pyridylthio ester, 17β (2-pyridylthiocarbonyl)-4-aza-5α-androstan-3-one, X followed by treatment of the ester with an amine of formula R^2-NH_2 wherein R^2 is as defined hereinabove to form a 17β (N-R^2-carbamoyl)-4-aza-5α-androstan-3-one XI which is dehydrogenated as previously described to produce compound XIV, 17β-(N-R^2-carbamoyl)-4-aza-androst-1-en-3-one.

In another alternated method of introducing the 17β-(N-R^2-carbamoyl) substituent into a 17β-carboxy androstane compound of formula VI, XII or IX, each is treated in a manner similar to the procedure described in Steroids, Vol. 35 #3, March 1980, p. 1-7 with dicyclohexylcarbodiimide and 1-hydroxybenzo-

triazole to form the 17β-(1-benzotriazoloxycarbonyl)-4-aza-5α-androst-1-en-3-one, VII, XIII or X, wherein X is 1-benzotriazoloxy or 17β-(1-benzo-triazoloxy-carbonyl)-4-aza-5α-androstan-3-one, X.

The above reactions are schematically represented in the following structural formula outline.



X is 2-pyridylthio or 1-benzotriazoloxy

The compounds used in the present invention, prepared in accordance with the method described above, are, as already described, potent anti-androgens by virtue of their ability to specifically inhibit testosterone-5α-reductase.

Accordingly, the present invention is particularly concerned with providing a use of the compounds of the present invention for treating the hyperandrogenic conditions of androgenic alopecia, including male

pattern alopecia by topical administration, and by systemic administration. compounds of the present invention.

The compositions containing the compounds of the present invention is the active ingredient for use in the treatment of benign prostatic hypertrophy can be administered in a wide variety of therapeutic dosage forms in conventional vehicles for systemic administration, as, for example, by oral administration in the form of tablets, capsules, solutions, or suspensions, of by intravenous injection. The daily dosage of the products may be varied over a wide range varying from 5 to 2,000 mg, preferably from 5 to 200 mg.

The compositions are preferably provided in the form of scored tablets containing 5, 10, 25, 50, 100, 150, 250, and 500 milligrams of the active ingredient for the symptomatic adjustment of the dosage to the patient to be treated. An effective amount of the drug is ordinarily supplied at a dosage level of from about 0.1 mg. to about 50 mg./kg. of body weight per day. Preferably the range is from about 0.1 mg to 7 mg./kgs. of body weight per day and more preferably from about 0.1 to about 3 mg/kg of body weight per day. These dosages are well below the toxic dose of the product. Capsules containing the product of this invention can be prepared by mixing an active compound of the present invention with lactose and magnesium stearate, calcium stearate, starch, talc, or other carriers, and placing the mixture in gelatin capsule. Tablets may be prepared by mixing the active ingredient with conventional tableting ingredients such as calcium phosphate, lactose, corn starch or magnesium stearate. The liquid forms in suitably flavored suspending or dispersing agents such as the synthetic and natural gums, for example, tragacanth, acacia, methyl-cellulose and the like. Other dispersing agents which may be employed include glycerin and the like. For parenteral administration, sterile suspensions and solutions are desired. Isotonic preparations which generally contain suitable preservative are employed when intravenous administration is desired.

For the treatment of androgenic alopecia, including male pattern alopecia, the compounds of the present invention are administered in the form of a pharmaceutical composition comprising the active compound in combination with a pharmacologically acceptable carrier adapted for topical administration. These topical pharmaceutical compositions may be in the form of a solution, cream, ointment, gel, lotion, shampoo or aerosol formulation adapted for application to the skin. These topical pharmaceutical compositions containing the compounds of the present invention ordinarily include above 0.1% to 15%, preferably about 0.1 to 5%, and more preferably about 0.1% to 2%, of the active compound, in admixture with a pharmaceutically acceptable carrier.

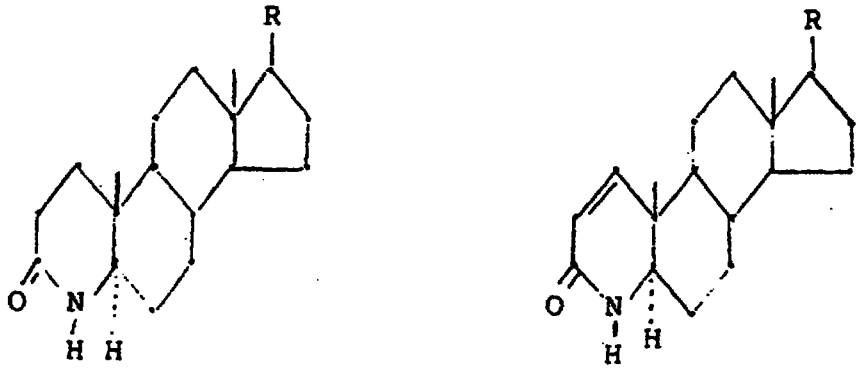
The method of preparing the novel compounds and compositions of the present invention, already described above in general terms, may be further illustrated by the following examples.

EXAMPLE 1

Methyl 3-oxo-4-aza-5α-androst-1-ene-17β-carboxylate

A suspension of 83.7 g of methyl 3-oxo-4-aza-5α-androstane-17-carboxylate* and 126.5 g of benzeneseleninic anhydride in 2.09 l of chlorobenzene was heated at reflux for 2 hours. The reflux condenser was switched to a distillation head and the mixture was distilled slowly to remove water that had formed in the reaction (2 hours). The solution was evaporated to leave 198 g of wet residue. The residue as a solution in dichloromethane was washed with saturated aqueous $NaHCO_3$ solution and saturated NaCl solution, then dried and evaporated to leave 172.4 g. This material was chromatographed on 2.56 kg of silica gel eluting first with dichloromethane (5 l) and then with 4:1 dichloromethaneacetone. The desired product eluted after 8 l and amounted to 53.4 g. It was rinsed with diethyl ether and dried to leave 49.5 g, m.p. 278-280 °C. In a similar fashion the following compounds were converted to their corresponding Δ 1 derivatives:

*Rasmusson Johnston and Arth. U.S. Patent 4,377,584, March 22, 1983.



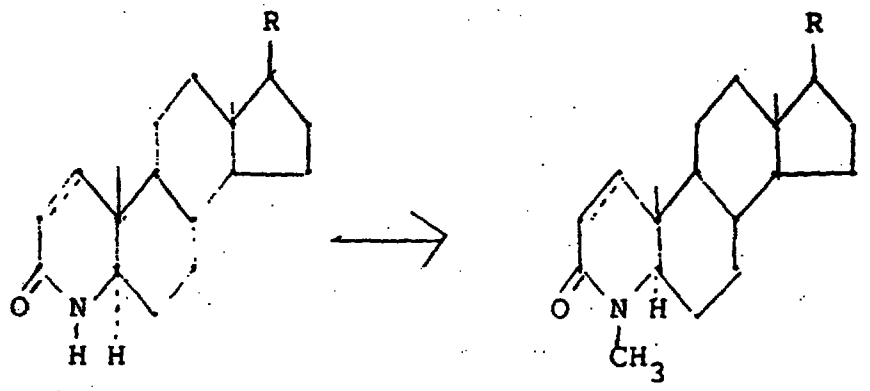
			m.p.
1a	R	= $CONHC(CH_3)_3$	252-254 °C
1b		= $CONHC(CH_3)_2CH_2C(CH_3)_3$	224-226 °

EXAMPLE 2

Methyl 4-methyl-3-oxo-4-aza-5α-androst-1-ene-17β-carboxylate

A suspension of 25 g of the product of Example 1 and 2.25 g of sodium hydride in 500 ml of dry dimethylformamide was stirred under nitrogen for 15 minutes. Methyl iodide (15 ml) was added dropwise and the mixture was stirred for 30 minutes at room temperature. Additional (5 ml) methyl iodide was added and the mixture was heated at 50 °C for 2 hours. After cooling the mixture was diluted with water to 2 l. The solid was separated after cooling and amounted to 25.4 g, m.p. 159-161 °C.

In a similar fashion the following compounds were converted to their corresponding 4-methyl derivatives:



			m.p.
2a	R	= $CONHC(CH_3)_2CH_2C(CH_3)_3$, androstane	148-150 °C
2b		= CONHC(CH3)3; Δ1-androstene	153-155 °
2c		= $CONHC(CH_3)_2CH_2C(CH_3)_3$ Δ1-androstene	168-170 °

EXAMPLE 3

S-(2-Pyridyl) 4-methyl-3-oxo-4-aza-5α-androst-1-ene-17β-thiocarboxylate

A suspension of 25 g of the product of Step 2 in 125 ml of methanol was treated with a solution of KOH (*12.5 g) in 12.5 ml of water. After refluxing for 4 hours, the solution was acidified with 6 NHCl and then was diluted with water. The crude acid (23.32 g) was separated, dried and had m.p. 300 °C.

The crude, dry acid (23 g), triphenyl-phosphine (36.45 g) and 2,2'-dipyridyldisulfide (30.4 g) were suspended in 138 ml of toluene with stirring for 3 hours at room temperature. The reaction mixture was directly chromatographed on a column of 4.5 kg of silica gel eluting with 9:1 ethyl acetate-acetone to give 20.4 g of the desired product, m.p. 218-220 °C.

Continued elution with acetone gave 5.2 g of the methanol addition product, S-(2-pyridyl) 1α-methoxy-4-methyl-3-oxo-4-aza-5α-androstane-17β-thio-carboxylate, m.p. 221-223 °C as a by-product.

3A. In a similar fashion the product of Example 1 was converted into S-(2-pyridyl) 3-oxo-4-aza-5α-androst-1-ene-17β-thiocarboxylate, m.p. 230-232 °C.

3B. In a similar manner methyl 3-oxo-4-aza-5α-androstone 17-carboxylate was converted into S-(2-pyridyl) 3-oxo-4-aza-5α-androstane-7β-thiocarboxylate, m.p. 232-234 °C.

EXAMPLE 4

N-t-Butyl 4-methyl-3-oxo-4-aza-5α-androst-1-ene-17β-carboxamide, m.p. 152-154 °C

Anhydrous et-butylamine was bubbled for 30 added into a suspension of 2.5 g of the puridylthioester of Example 3 in 70 ml of tetrahydrofuran. After 60 minutes exposure, the resulting solution was evaporated and the residue was chromatographed on 125 g of silica gel. Elution with 20:1 ethyl acetate dichloromethane afforded 1.5 g of the product, m.p. 152-154 °C.

When the example is repeated using an appropriate amine and an appropriate pyridylthioester, the following product were obtained:

4b: N-t-butyl 3-oxo-4-aza-5α-androstane-17β-carboxamide, m.p. 275-276 °C.

4c: N-(2,4,4-trimethyl-2-pentyl) 4-methyl-3-oxo-4-aza-5α-androst-1-ene-17β-carboxamide, m.p. 168-170 °C.

EXAMPLE 5

5-Oxo-3,5-secoetian-3,20-dioic acid

To a solution of 200 g of 3-oxo-4-etien-20-oic acid in 3.5 l of t-butanol at 80° was added a solution of 198.4 g of sodium carbonate in 474 ml of water. A warm (65 °C) solution of 948.5 g of sodium metaperiodate and 6.95 g of permanganate in 3.5 l of water was added at such a rate that the reaction mixture was maintained at 80 °C. After addition the mixture was heated at reflux for one hour. The mixture stood at room temperature overnight. The inorganic salts were removed by filtration and the cake was washed with 225 ml of water. A solution of 5% aqueous sodium bisulfite was added to reduce the iodine that was present. The t-butanol was removed under reduced pressure and the aqueous residue was acidified with conc. hydrochloric acid. The separated gum was extracted into dichloromethane and was washed with 5% aqueous sodium bisulfite, saturated sodium chloride solution, then dried and concentrated to an off-white residue (214 g). Crystalline material was obtained by suspending the residue in ether and diluting with hexane to give 152 g, m.p. 189-192 °C.

EXAMPLE 5B

3-Oxo-4-aza-5-etien-20-oic acid

A suspension of 64.7 g of the dioic acid of Step 5 in 350 ml of ethylene glycol was treated with 80 ml of liquid ammonia. The resulting solution was heated at a rate of 3 °/min. up to 180 °C and was held at that temperature for 15 minutes. After cooling, 1 liter of water was added and the mixture was acidified with 10% hydrochloric acid to a pH of 1.5. The product was removed and washed with water, then air dried to leave 57.5 g of the product, m.p. 310 °C.

EXAMPLE 5C

3-Oxo-4-aza-5-etian-20-oic acid

A solution of 136 g of the Δ5-acid of Example 5B in 16.32 ml of acetic acid was hydrogenated at 60 °C in the presence of platinum catalyst (from 16.32 g of PtO_2) at 40 psig for 3 hours. The catalyst was removed and the solution concentrated to give 128.2 g of crude product. The material was washed well with 3 l of water then filtered and air dried to leave 125 g of the white solid, m.p. 310 °.

This material is also obtained by saponification of methyl 3-oxo-4-aza-5α-androstane-17β-carboxylate (methyl 3-oxo-4-aza-5α-etien-20-oate) in 7% methanolic potassium hydroxide followed by an acidic work-up.

EXAMPLE 5D

N-(2,4,4-Trimethyl-2-pentyl) 3-oxo-4-aza-5α-androstane-17β-carboxamide

A solution of 5.0 g of the product of Example 5C, 3.35 g of dicyclohexylcarbodiimide and 3.18 g of 1-hydroxybenztriazole in 500 ml of dichloromethane was stirred at room temperature overnight. The solid was separated by filtration and the filtrate was treated with 2,4,4-trimethyl-2-pentylamine (t-octylamine). This solution stood at room temperature for 64 hours. A small amount of solid was removed and the solution was washed successively with 10% aqueous sodium hydroxide, water, 10% hydrochloric acid and saturated aqueous sodium chloride. After drying and concentration the crude product was eluted through 240 g of silica gel with 3:7 acetone-dichloromethane to give 5.5g of the product, m.p. 250-251 °C.

EXAMPLE 5E

Example 5D is repeated using t-butylamine in place of 2,2,4-trimethyl-2-pentylamine to obtain N-t-butyl 3-oxo-4-aza-5α-androstane-17β-carboxamide, m.p. 274-276 °C.

EXAMPLE 6

Alcoholic Solution	
17β-(N-tertbutylcarbamoyl)-4-aza-5α-androst-1-en-3-one	15.0% by weight
Water	45
Ethyl Alcohol	40

EXAMPLE 7

Topical Cleanser	
17β-(N-tertbutylcarbamoyl)-4-aza-5α-androst-1-en-3-one	10.00% by weight
Water	70.439
Chamomile	0.01
Aloe vera gel	0.01
Allantoin	0.001
Triethanolomine	0.02
METHOCEL® 40-100 (Dow)	1.50
Glycerine	3.00
Sodium lauryl sulfate	15.00
Vitamin A oil	0.1
Vitamine E oil	0.01

EXAMPLE 8

Cleansing Cream	
17β-(N-tertbutylcarbamoyl)-4-aza-5α-androst-1-en-3-one	5.0% by weight
Synthetic beeswax	14.0
PPG2 Myristyl propionate	5.0
Lanolin Alcohol	0.5
Mineral Oil	36.0
Propyl Paraben	0.15
Sodium Borate	1.0
Water	38.35

EXAMPLE 9

Skin Gel	
17β-(N-tertbutylcarbamoyl)-4-aza-5α-androst-1-en-3-one	2.00% by weight
PPG2 Myristyl Ether Propionate	45.00
PPG10 Cetyl Ether	5.00
C18-C36 Triglyceride	4.00
Myristyl Myristate	3.00
Glyceryl Tribebenate	2.00
Cyclomethicone	34.00
Polyethylene	5.00

EXAMPLE 10

Skin Lotion	
17β-(N-tertbutylcarbamoyl)-4-aza-5α-androst-1-en-3-one	1.0% by weight
DEA Oleth 3 Phosphate	1.0
Emulsifying Wax	2.0
C18-C36 Wax Fatty Acids	1.0
PPG2 Myristyl Propionate	5.0
Glycerine	3.0
Triethanolamine	0.5
Water	86.5

EXAMPLE 11

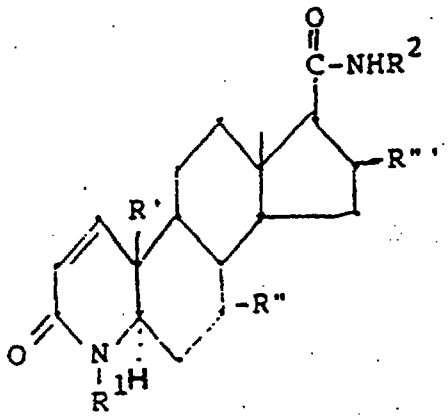
Shampoo Gel	
17β-(N-tertbutylcarbamoyl)-4-aza-5α-androst-1-en-3-one	2.0% by weight
Isopropanolamine Lauryl Sulfate	81.5
Cocoamide DEA	8.0
C18-C36 Wax Acid Glyceryl Ester	4.5
PPG5 Ceteth 10 Phosphate	4.0

EXAMPLE 12

Cream Shampoo	
17β-(N-tertbutylcarbamoyl)-4-aza-5α-androst-1-en-3-one	0.1% by weight
Sodium Laureth Sulfate	65.0
Glyceryl Tribebenate	2.0
Hydrolysed Collagen	1.0
Lauric Diethanolamide	5.0
Water	26.9

Claims

1. The use of a compound of the formula



(wherein:
R^1 is hydrogen, methyl or ethyl;
R^2 is a branched chain alkyl of from 3-12 carbon atoms;
R' is hydrogen or methyl;
R'' is hydrogen or β-methyl;
R''' is hydrogen, α-methyl or β-methyl) for the manufacture of a medicament useful for treating androgenic alopecia.

2. The use as claimed in Claim 1 wherein:
R^1 is hydrogen or methyl;
R^2 is branched chain alkyl of from 4-8 carbon atoms;
R', R'', R''' are hydrogen.

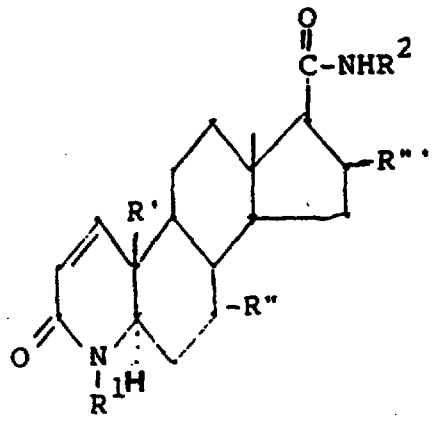
3. The use as claim in Claim 1 wherein the compounds are
17β-(N-tertbutylcarbamoyl)-4-aza-4-methyl-5α-androst-1-en-3-one;
17β-(N-tertbutylcarbamoyl)-4-aza-5α-androst-1-en-3-one;
17β-(N-isobutylcarbamoyl)-4-aza-4-methyl-5α-androst-1-en-3-one;
17β-(N-isobutylcarbamoyl)-4-aza-5α-androst-1-en-3-one;
17β-(N-tert-octylcarbamoyl)-4-aza-4-methyl-5α-androst-1-en-3-one;
17β-(N-tert-octylcarbamoyl)-4-aza-5α-androst-1-en-3-one;
17β-(N-1,1-diethylbutylcarbamoyl)-4-aza-4-methyl-5α-androst-1-en-3-one;
17β-(N-1,1-diethylbutylcarbamoyl)-4-aza-5-androst-1-en-3-one;
17β-(N-tert-hexylcarbamoyl)-4-aza-4-methyl-5α-androst-1-en-3-one; or
17β-(N-tert-hexylcarbamoyl)-4-aza-5-androst-1-en-3-one.

EXAMPLE 12

Cream Shampoo	
17β-(N-tertbutylcarbamoyl)-4-aza-5α-androst-1-en-3-one	0.1% by weight
Sodium Laureth Sulfate	65.0
Glyceryl Tribebenate	2.0
Hydrolysed Collagen	1.0
Lauric Diethanolamide	5.0
Water	26.9

Claims

1. The use of a compound of the formula



(wherein:
R^1 is hydrogen, methyl or ethyl;
R^2 is a branched chain alkyl of from 3-12 carbon atoms;
R' is hydrogen or methyl;
R'' is hydrogen or β-methyl;
R''' is hydrogen, α-methyl or β-methyl) for the manufacture of a medicament useful for treating androgenic alopecia.

2. The use as claimed in Claim 1 wherein:
R^1 is hydrogen or methyl;
R^2 is branched chain alkyl of from 4-8 carbon atoms;
R', R'', R''' are hydrogen.

3. The use as claim in Claim 1 wherein the compounds are
17β-(N-tertbutylcarbamoyl)-4-aza-4-methyl-5α-androst-1-en-3-one;
17β-(N-tertbutylcarbamoyl)-4-aza-5α-androst-1-en-3-one;
17β-(N-isobutylcarbamoyl)-4-aza-4-methyl-5α-androst-1-en-3-one;
17β-(N-isobutylcarbamoyl)-4-aza-5α-androst--en-3-one;
17β-(N-tert-octylcarbamoyl)-4-aza-4-methyl-5α-androst-1-en-3-one;
17β-(N-tert-octylcarbamoyl)-4-aza-5α-androst-1-en-3-one;
17β-(N-1,1-diethylbutylcarbamoyl)-4-aza-4-methyl-5α-androst-1-en-3-one;
17β-(N-1,1-diethylbutylcarbamoyl)-4-aza-5-androst-1-en-3-one;
17β-(N-tert-hexylcarbamoyl)-4-aza-4-methyl-5α-androst-1-en-3-one; or
17β-(N-tert-hexylcarbamoyl)-4-aza-5-androst-1-en-3-one.

4. The use as claimed in Claim 3 wherein the compound is 17β-(N-tertbutylcarbamoyl)-4-aza-5α-androst-1-en-3-one.

5. The use of 17β-(N-tertbutylcarbamoyl)-4-aza-5α-androst-1-en-3-one for the manufacture of a medicament useful for arresting and reversing androgenic alopecia.

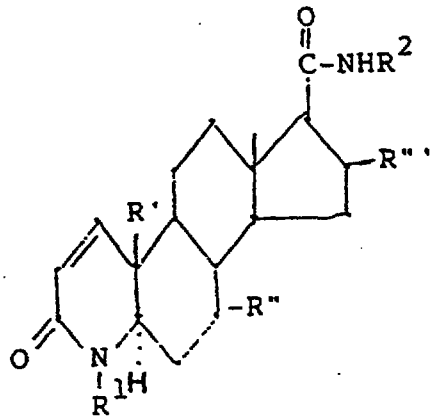
6. The use as claimed in any one of the preceding claims wherein the androgenic alopecia is male pattern alopecia.

7. The use as claimed in any one of the preceding claims wherein the medicament manufactured contains about 0.1% to 15% of compound and a pharmaceutically acceptable carrier.

8. The use as claimed in any one of the preceding claims wherein the medicament manufactured is a solution, cream, ointment, gel, lotion, shampoo or aerosol.

Patentansprüche

1. Verwendung einer Verbindung der Formel



in der
R^1 Wasserstoff, Methyl oder Ethyl,
R^2 verzweigtkettiges Alkyl mit 3-12 Kohlenstoffatomen,
R' Wasserstoff oder Methyl,
R" Wasserstoff oder β-Methyl,
R"' Wasserstoff, α-Methyl oder β-Methyl bedeuten,
zur Herstellung eines Arzneimittels, das zur Behandlung der androgenen Alopezie verwendbar ist.

2. Verwendung gemäß Anspruch 1, worin
R^1 Wasserstoff oder Methyl,
R^2 verzweigtkettiges Alkyl mit 4-8 Kohlenstoffatomen und
R', R" und R"' Wasserstoff bedeuten.

3. Verwendung gemäß Anspruch 1, worin die Verbindungen
17β-(N-tert.Butylcarbamoyl)-4-aza-4-methyl-5α-androst-1-en-3-on,
17β-(N-tert.Butylcarbamoyl)-4-aza-5α-androst-1-en-3-on,
17β-(N-Isobutylcarbamoyl)-4-aza-4-methyl-5α-androst-1-en-3-on,
17β- (N-Isobutylcarbamoyl)-4-aza-5α-androst-1-en-3-on,
17β-(N-tert.Octylcarbamoyl)-4-aza-4-methyl-5α-androst-1-en-3-on,
17β-(N-tert.Octylcarbamoyl)-4-aza-5α-androst-1-en-3-on,
17β-(N-1,1-Diethylbutylcarbamoyl)-4-aza-4-methyl-5α-androst-1-en-3-on,
17β-(N-1,1-Diethylbutylcarbamoyl)-4-aza-5α-androst-1-en-3-on,

17β-(N-tert.Hexylcarbamoyl)-4-aza-4-methyl-5α-androst-1-en-3-on oder
17β-(N-tert.Hexylcarbamoyl)-4-aza-5α-androst-1-en-3-on sind.

4. Verwendung gemäß Anspruch 3, worin die Verbindung 17β-(N-tert.Butylcarbamoyl)-4-aza-5α-androst-1-en-3-on ist.

5. Verwendung von 17β-(N-tert.Butylcarbamoyl)-4-aza-5α-androst-1-en-3-on zur Herstellung eines Arzneimittels, das für die Hemmung der androgenen Alopezie und deren Rückwandlung brauchbar ist.

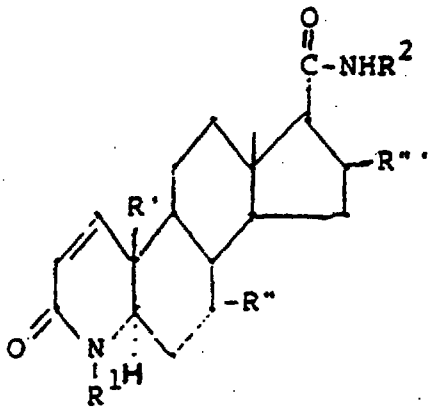
6. Verwendung gemäß jedem der vorhergehenden Ansprüche, worin die androgene Alopezie eine Alopezie der männlichen Form ist.

7. Verwendung gemäß jedem der vorhergehenden Ansprüche, worin das hergestellte Arzneimittel etwa 0,1% bis 15% der Verbindung und einen pharmazeutisch annehmbaren Träger enthält.

8. Verwendung gemäß jedem der vorhergehenden Ansprüche, worin das hergestellte Arzneimittel eine Lösung, eine Creme, eine Salbe, ein Gel, ein Shampoo oder ein Aerosol ist.

Revendications

1. Utilisation d'un composé de formule



dans laquelle R^1 est un atome d'hydrogène, un groupe méthyle ou éthyle;
R^2 est une chaîne alkyle ramifiée de 3-12 atomes de carbone
R' est un atome d'hydrogène ou un groupe méthyle;
R'' est un atome d'hydrogène ou un groupe β-méthyle;
R''' est un atome d'hydrogène, un groupe α-méthyle ou β-méthyle; pour la fabrication d'un médicament utile pour traiter l'alopécie androgène.

2. Utilisation selon la revendication 1, dans laquelle :
R^1 est un atome d'hydrogène ou un groupe méthyle;
R^2 est un groupe alkyle à chaîne ramifiée de 4-8 atomes de carbone;
R', R'', R''' sont des atomes d'hydrogène.

3. Utilisation selon la revendication 1, dans laquelle les composés sont
17β-(N-t-butylcarbamoyl)-4-aza-4-méthyl-5α-androst-1-ène-3-one
17β-(N-t-butylcarbamoyl)-4-aza-5α-androst-1-ène-3-one
17β-(N-isobutylcarbamoyl)-4-aza-4-méthyl-5α-androst-1-ène-3-one,
17β-(N-isobutylcarbamoyl)-4-aza-5α-androst-1-ène-3-one,
17β-(N-t-octylcarbamoyl)-4-aza-4-méthyl-5α-androst-1-ène-3-one,
17β-(N-t-octylcarbamoyl)-4-aza-5α-androst-1-ène-3-one,
17β-(n-1,1-diéthylbutylcarbamoyl)-4-aza-4-méthyl-5α-androst-1-ène-3-one,
17β-(n-1,1-diéthylbutylcarbamoyl)-4-aza-5α-androst-1-ène-3-one,

* C L M S *

17β-(N-t-hexylcarbamoyl)-4-aza-4-méthyl-5α-androst-1-ène-3-one.
17β-(N-t-hexylcarbamoyl)-4-aza-5α-androst-1-ène-3-one.

4. Utilisation selon la revendication 3 dans laquelle le composé est la 17β-(N-t-butylcarbamoyl)-4-aza-5α-androst-1-ène-3-one.

5. Utilisation de la 17β-(N-t-butylcarbamoyl)-4-aza-5α-androst-1-ène-3-one pour fabriquer un médicament utile pour arrêter et inverser l'alopécie androgène.

6. Utilisation selon l'une quelconque des revendications précédentes, dans laquelle l'alopécie androgène est une calvitie hippocratique.

7. Utilisation selon l'une quelconque des revendications précédentes, dans laquelle le médicament fabriqué contient environ 0,1% à 15% d'un composé et un véhicule pharmaceutiquement acceptable.

8. Utilisation selon l'une quelconque des revendications précédentes, dans laquelle le médicament fabriqué est une solution, une crème, une pommade, un gel, une lotion, un shampooing ou un aérosol.