



Research Journal of Pharmaceutical, Biological and Chemical Sciences

Structure and Biological Activities: Steroid Moieties

Meher CP*, Sethy SP, and Pochaiah B

Department of pharmaceutical Chemistry, Maheshwara college of Pharmacy, chitkul (V), Isnapur "X" Road, patancheru, Hyderabad.

ABSTRACT

A steroid is a type of organic compound that contains a characteristic arrangement of four cycloalkane rings that are joined to each other. The core of steroids is composed of twenty carbon atoms bonded together that take the form of four fused rings, three cyclohexane rings and one cyclopentane ring. The steroids vary by the functional groups attached to this four-ring core and by the oxidation state of the rings. Steroid derivatives have occupied a unique place in the field of medicinal chemistry for their therapeutic values. This articles aims to review the work reported, their chemistry and biological activities of Steroid derivatives during past years.

Keywords: Cyclopentanoperhydrophenanthrene nucleus, Clinical trials, neoplastic drugs, contraceptive, pharmaceutical drugs.

**Corresponding author*

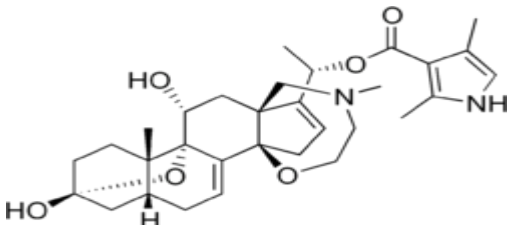
INTRODUCTION

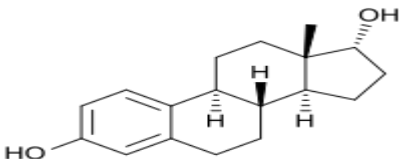
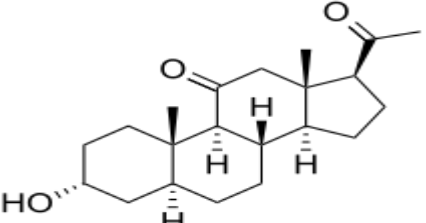
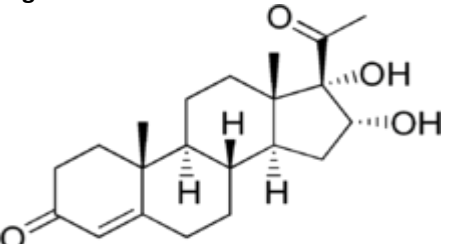
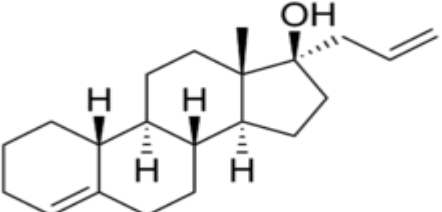
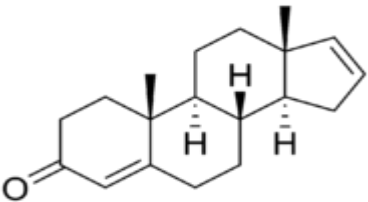
Sterols are special forms of steroids, with a hydroxyl group at position-3 and a skeleton derived from cholestane. Examples of steroids include the dietary fat cholesterol, the sex hormones estradiol and testosterone, and the anti-inflammatory drug dexamethasone. Hundreds of distinct steroids are found in plants, animals, and fungi. All steroids are made in cells either from the sterols lanosterol (animals and fungi) or from cycloartenol (plants). Both lanosterol and cycloartenol are derived from the cyclization of the triterpene squalene. Steroid may be divided in the following manner:

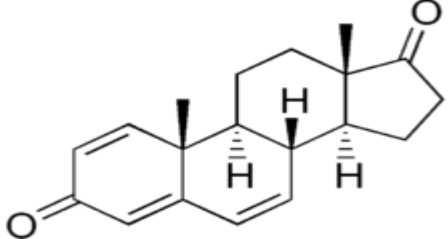
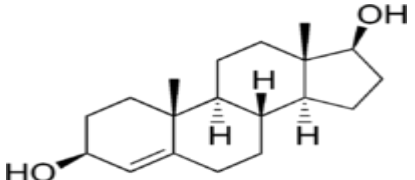
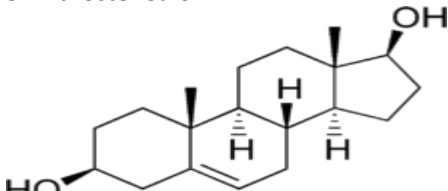
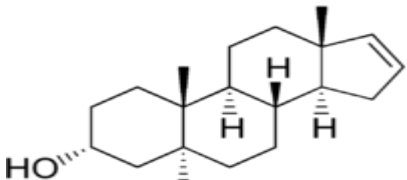
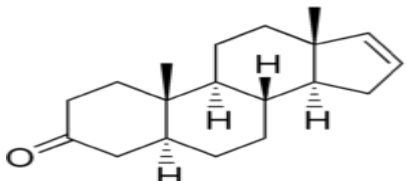
- Sterols- cholesterol, ergosterol, coprosterol
- Bile acids - glycolic acid, taurocholic acid
- Sex hormone- testosterone, estradiol
- Vitamin D- vitamin D₂ & D₃
- Adrenocortical hormone- corticosterone
- Cardiac glycoside- stropanthine
- Saponin- digitonin

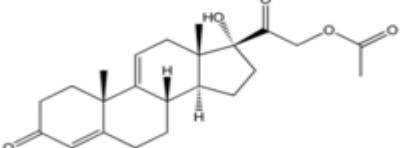
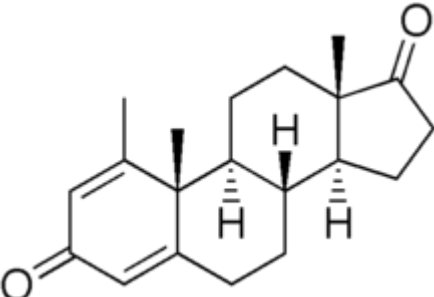
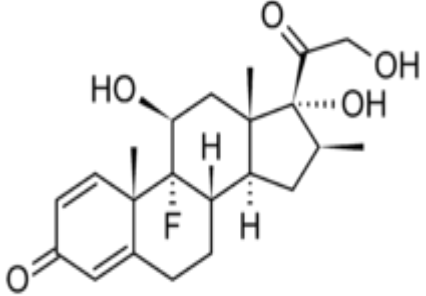
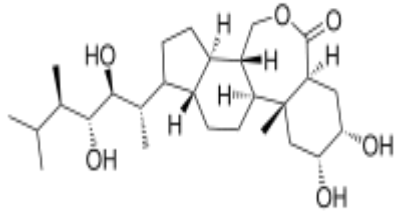
Medicinal chemistry is the discipline concerned with determining the influence of chemical structure on biological activity and in the practice of medicinal chemistry developed from an empirical one involving organic synthesis of new compound based largely on the modification of structure and then identifies their biological activity. Medicinal chemistry concerns with the discovery, development, interpretation and the identification of mechanism of action of biologically active compounds at the molecular level. Various type of steroid are synthesizes till now & are numerous compound are under clinical trials which are found to be most promising in the health care system. Few examples are given below along with their pharmacological effect in table-1.

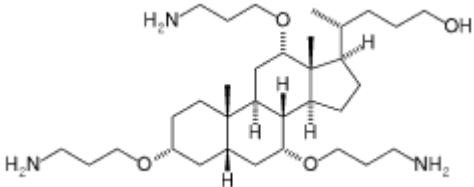
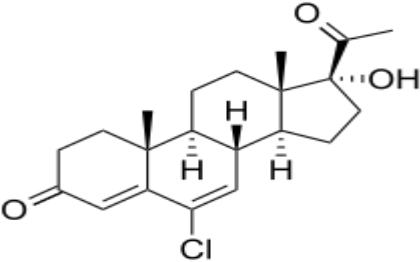
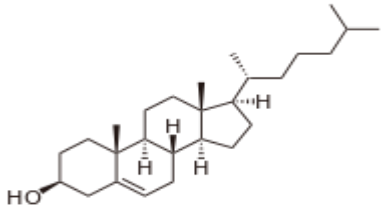
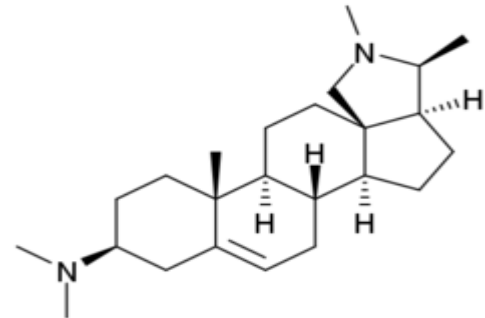
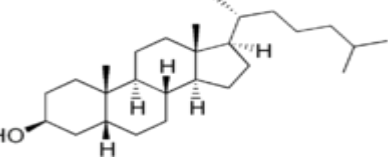
Table-1

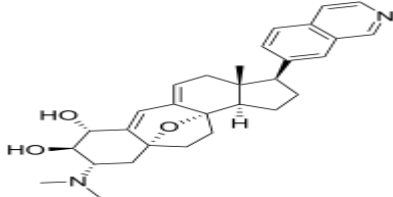
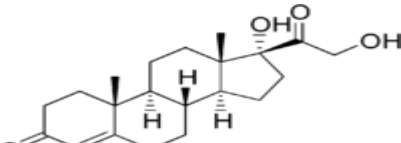
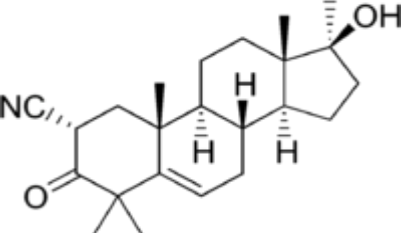
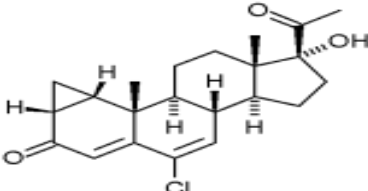
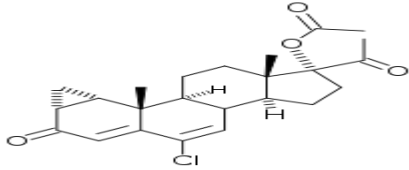
Name of compound	Pharmacological Uses	References
<p>Batrachotoxin</p> 	<p>It is a potent cardiotoxic and neurotoxic steroidal alkaloids</p>	<p>Tokuyama, T.et.al [1]</p>

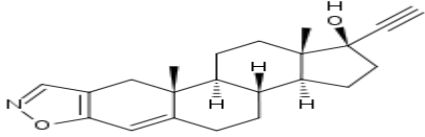
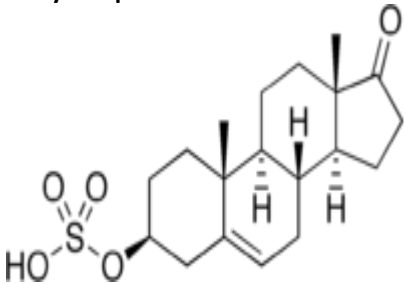
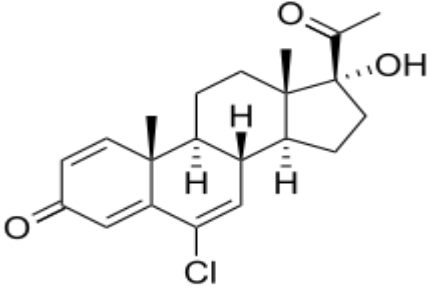
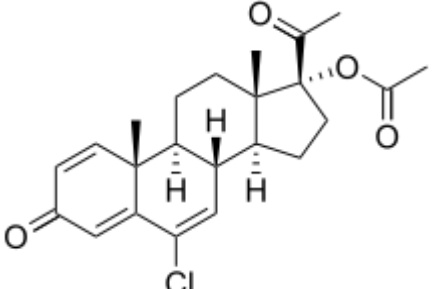
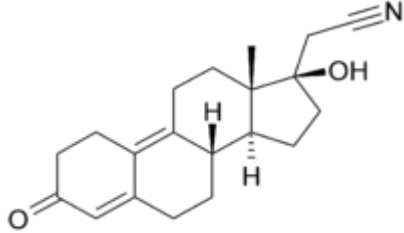
<p>Alfatradiol</p>  <p>Estra-1,3,5(10)-triene-3,17α-diol</p>	<p>Used for the treatment of androgenic alopecia (hair loss) in men and women</p>	<p>Berger.et.al [2]</p>
<p>Alfaxolone/alfadolone</p> 	<p>Used as anaesthetic agent</p>	<p>Clarke, R. S.et.al [3]</p>
<p>Algestone</p>  <p>16α,17α-dihydroxypregn-4-ene-3,20-dione</p>	<p>Used as a contraceptive drug</p>	<p>A. D. Roberts.et.al [4]</p>
<p>Allylestrenol</p>  <p>(17β)-17-(prop-2-en-1-yl)estr-4-en-17-ol</p>	<p>Used to prevent threatened miscarriage, recurrent pregnancy loss and premature labor.</p>	<p>Sweetman.et.al [5]</p>
<p>Androstadienone</p>  <p>(8S,9S,10R,13R,14S)-10,13-dimethyl-1,2,6,7,8,9,11,12,14,15-decahydrocyclopenta[a]phenanthren-3-one</p>	<p>Androstadienone is commonly sold in male fragrances, it is purported, to increase sexual attraction.</p>	<p>Wyart C.et.al [6]</p>
<p>1,4,6-Androstatriene-3,17-dione</p>	<p>It is used to control estrogen synthesis</p>	<p>Adkins-Regan.et.al [7]</p>

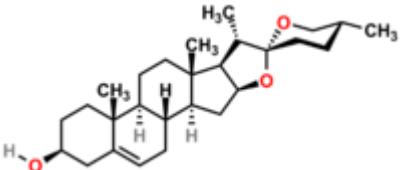
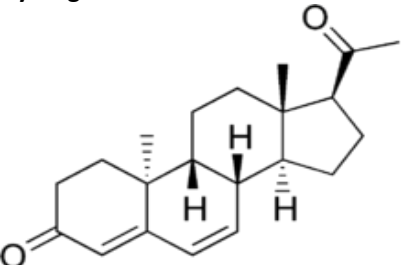
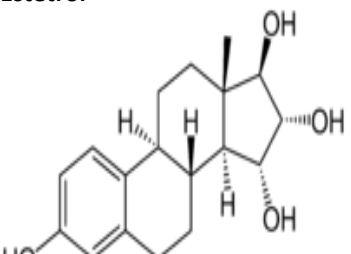
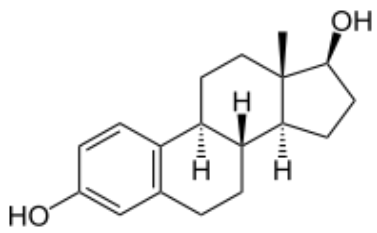
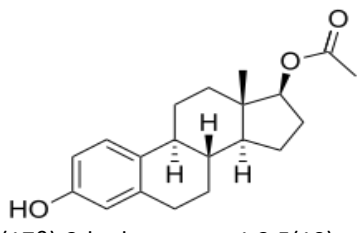
 <p>(8R,9S,10R,13S,14S)-10,13-dimethyl-9,11,12,14,15,16-hexahydro-8H-cyclopenta[a]phenanthrene-3,17-dione</p>		
<p>4-Androstenediol</p>  <p>(3S,8R,9S,10R,13S,14S,17S)-10,13-dimethyl-2,3,6,7,8,9,11,12,14,15,16,17-dodecahydro-1H-cyclopenta[a]phenanthrene-3,17-diol</p> <p>5-Androstenediol</p>  <p>(3S,8R,9S,10R,13S,14S,17S)-10,13-Dimethyl-2,3,4,7,8,9,11,12,14,15,16,17-dodecahydro-1H-cyclopenta[a]phenanthrene-3,17-diol</p>	<p>It has androgenic effects</p> <p>Its potential use as a radiation countermeasure</p>	<p>Chen F.et.al [8]</p> <p>Whitnall MH.et.al [9]</p>
<p>Androstenol</p>  <p>(2R,5R,7S,15R)-2,15-dimethyltetracyclo[8.7.0.0^{2,7}.0^{11,15}]heptadec-13-en-5-ol</p>	<p>It is analogous to sex hormones</p>	<p>Kirk-Smith.et.al [10]</p>
<p>Androstenone</p>  <p>(5S,8R,9S,10S,13R,14S)-10,13-dimethyl-1,2,4,5,6,7,8,9,11,12,14,15-dodecahydrocyclopenta[a]phenanthren-3-one</p>	<p>Androstenone is the active ingredient in 'Boarmate', a commercial product made by DuPont sold to pig farmers to test sows for timing of artificial insemination.</p>	<p>Kirk-Smith.et.al [11]</p>
<p>Anecortave</p>	<p>It is used in the treatment of the exudative (wet) form of age-related macular degeneration</p>	<p>Reid J.G et.al [12]</p>

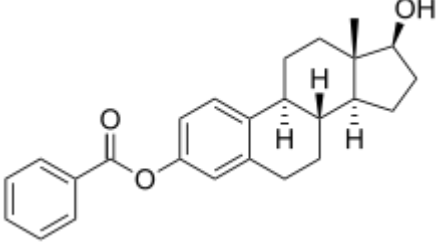
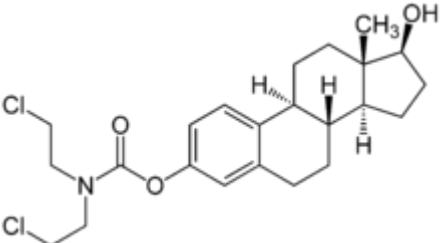
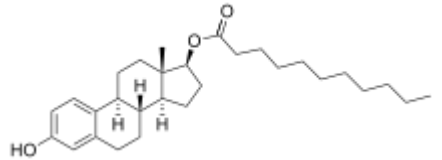
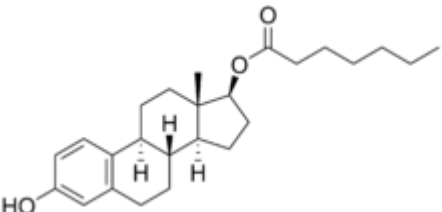
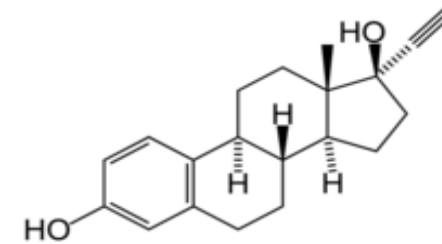
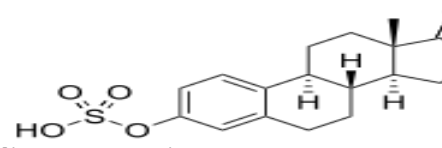
 <p>[2-[(8R,10S,13S,14R,17R)-17-hydroxy-10,13-dimethyl-3-oxo-2,6,7,8,12,14,15,16-octahydro-1H-cyclopenta[a]phenanthren-17-yl]-2-oxo-ethyl] acetate</p>		
<p>Atamestane</p>  <p>(8R,9S,10S,13S,14S)-1,10,13-Trimethyl-7,8,9,11,12,14,15,16-octahydro-6H-cyclopenta[a]phenanthrene-3,17-dione</p>	<p>Atamestane is an aromatase inhibitor that is being studied in the treatment of cancer.</p>	<p>Etreby MF.et.al [13]</p>
<p>Betamethasone</p>  <p>(8S,9R,10S,11S,13S,14S,16S,17R)-9-fluoro-11,17-dihydroxy-17-(2-hydroxyacetyl)-10,13,16-trimethyl-6,7,8,9,10,11,12,13,14,15,16,17-dodecahydro-3H-cyclopenta[a]phenanthren-3-one</p>	<p>It has anti-inflammatory and immunosuppressive properties</p>	<p>Chu C.C.et.al [14]</p>
<p>Brassinolide</p>  <p>(3aS,5S,6R,7aR,7bS,9aS,10R,12aS,12bS)-10-[(2S,3R,4R,5S)-3,4-Dihydroxy-5,6-dimethyl-2-heptyl]-5,6-dihydroxy-7a,9a-dimethylhexadecahydro-3H-benzo[c]indeno[5,4-e]oxepin-3-one</p>	<p>Brassinolide is a plant hormone.</p>	<p>Grove.et.al [15]</p>
<p>Ceragenin</p>	<p>It shows road spectrum</p>	<p>Savage P.B.et.al</p>

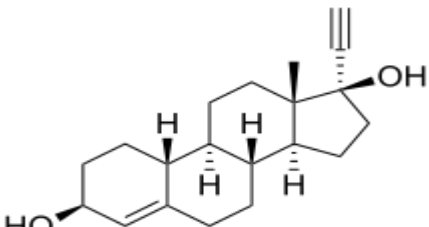
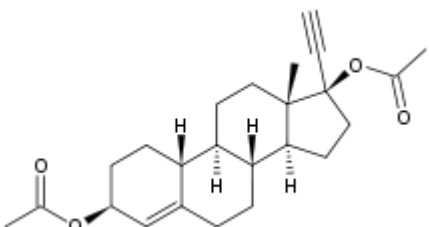
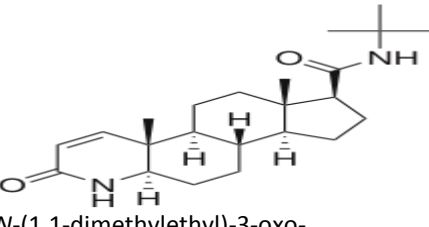
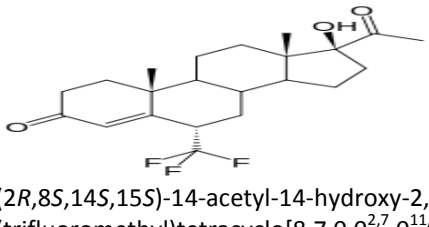
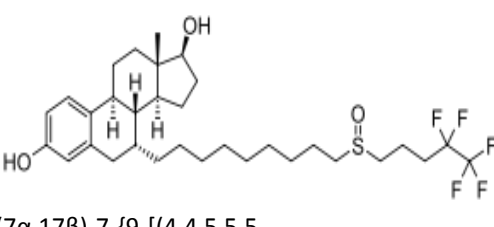
	antibacterial activity.	[16]
<p>Chlormadinone</p>  <p>6-chloro-17α-hydroxypregna-4,6-diene-3,20-dione</p>	clinically used as a pharmaceutical drug	Macdonald.et.al [17]
<p>Cholesterol</p>  <p>(3β)-cholest-5-en-3-ol</p>	It serves as a precursor for the biosynthesis of steroid hormones, bile acids, and vitamin D	Hanukoglu I.et.al [18]
<p>Conessine</p>  <p>N,N-Dimethyl-con-5-enin-3-amine</p>	Used for treatment of amoebic dysentery	Garg S.et.al [19]
<p>Coprostanol</p>  <p>5β-cholestan-3β-ol</p>	This compound has frequently been used as a biomarker for the presence of human faecal matter in the environment.	Mudge S.M.et.al [20]
<p>Cortistatins</p>	Represses viral replication in cells infected with HIV via binding to the Tat protein	Aoki S.et.al [21]

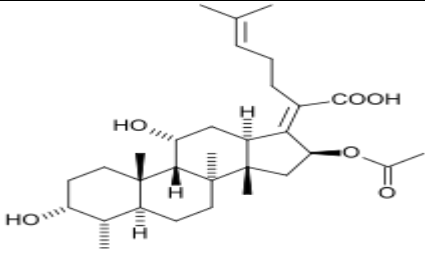
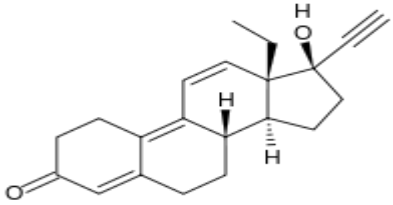
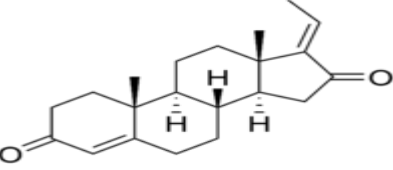
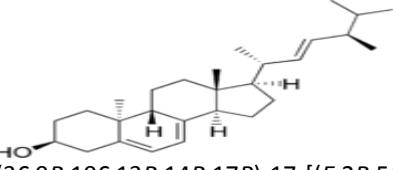
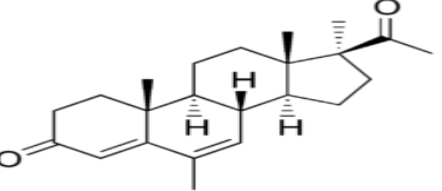
 <p>(1R,2R,3S,5R,8β,17β)-3-(Dimethylamino)-17-(isoquinolin-7-yl)-5,8-epoxy-9,19-cyclo-9,10-secoandrosta-9(11),10-diene-1,2-diol</p>		
<p>Cortodoxone</p>  <p>(8R,9S,10R,13S,14S,17R)-17-hydroxy-17-(2-hydroxyacetyl)-10,13-dimethyl-2,6,7,8,9,11,12,14,15,16-decahydro-1H-cyclopenta[a]phenanthren-3-one</p>	<p>Cortodoxone functions as a mineralocorticoid</p>	<p>Peterson DH.et.al [22]</p>
<p>Cyanoketone</p>  <p>(2S,8R,9S,10R,13S,14S,17S)-17-hydroxy-4,4,10,13,17-pentamethyl-3-oxo-1,2,7,8,9,11,12,14,15,16-decahydrocyclopenta[a]phenanthrene-2-carbonitrile</p>	<p>It has been shown to inhibit steroidogenesis</p>	<p>Di Prisco [23]</p>
<p>Cyproterone</p>  <p>6-chloro-17-hydroxy-1α,2α-methylenepregna-4,6-diene-3,20-dione</p>	<p>It is a steroidal antiandrogen</p>	<p>Taylor.et.al [24]</p>
<p>Cyproterone acetate</p>  <p>6-chloro-17-hydroxy-1α,2α-methylenepregna-4,6-diene-3,20-dione</p>	<p>it can also be used to treat acne and hirsutism in females</p>	<p>Neumann F.et.al [25]</p>
<p>Danazol</p>	<p>Its role as a treatment for endometriosis has been largely replaced by the GnRH agonists.</p>	<p>Dmowski W.P.et.al [26]</p>

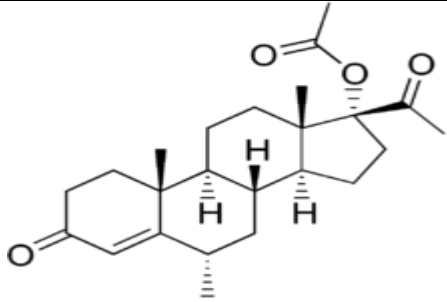
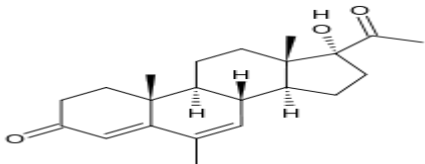
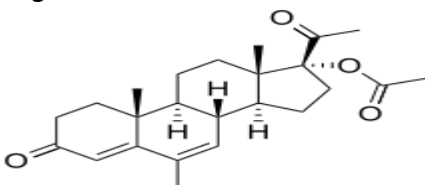
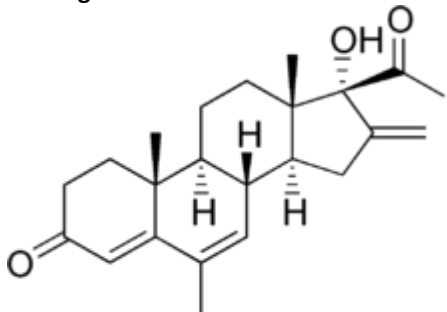
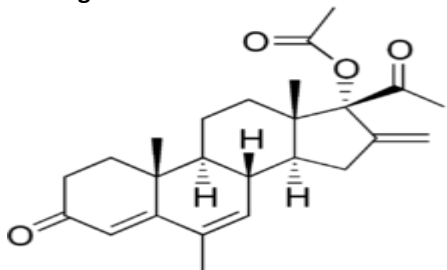
 <p>(1S,2R,13R,14S,17R,18S)-17-ethynyl-2,18-dimethyl-7-oxa-6-azapentacyclo[11.7.0.0^{2,10}.0^{4,8}.0^{14,18}]icosa-4(8),5,9-trien-17-ol</p>		
<p>Dehydroepiandrosterone sulfate</p>  <p>[(3S,8R,9S,10R,13S,14S)-10,13-Dimethyl-17-oxo-1,2,3,4,7,8,9,11,12,14,15,16-dodecahydrocyclopenta[a]phenanthren-3-yl] hydrogen sulfate</p>	<p>Use as biomarker</p>	<p>Rainey W.E.et.al [27]</p>
<p>Delmadinone</p>  <p>6-chloro-17-hydroxypregna-1,4,6-triene-3,20-dione</p>	<p>It is used in veterinary medicine.</p>	<p>Macdonald.et.al [28]</p>
<p>Delmadinone acetate</p>  <p>6-chloro-3,20-dioxopregna-1,4,6-trien-17-yl acetate</p>	<p>It is used to treat androgen-associated conditions in veterinary medicine</p>	<p>Macdonald.et.al [28]</p>
<p>Dienogest</p> 	<p>It is available for use as an oral contraceptive in combination with ethinylestradio</p>	<p>Foster R.H.et.al [29]</p>

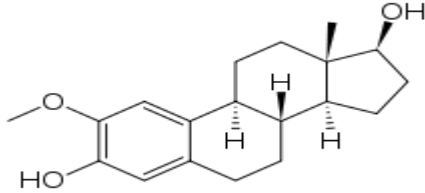
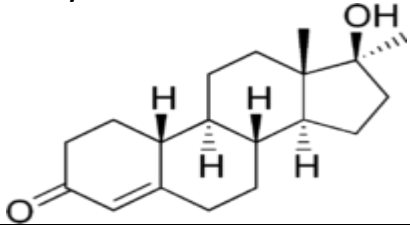
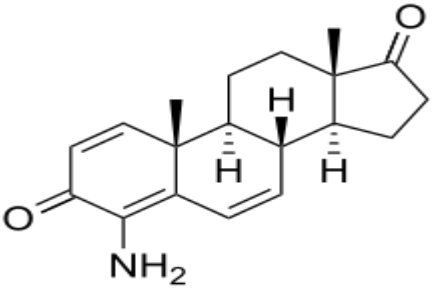
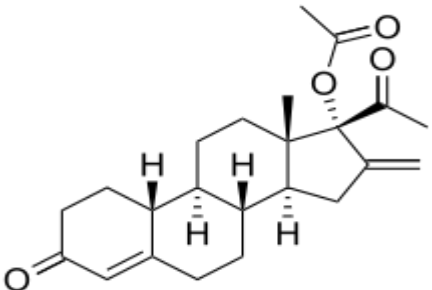
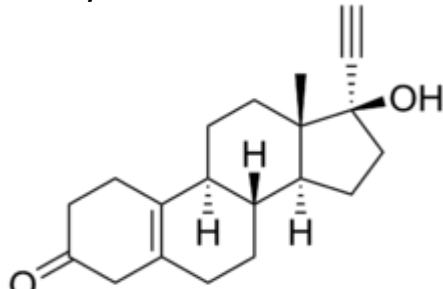
17-hydroxy-3-oxo-19-nor-17 α -pregna-4,9-diene-21-nitrile		
<p>Diosgenin</p>  <p>(3β,25R)-spirost-5-en-3-ol</p>	Diosgenin is used for the commercial synthesis of cortisone, pregnenolone, progesterone, and other steroid products.	Djerassi C.et.al [30]
<p>Dydrogesterone</p>  <p>(9β,10α)-pregna-4,6-diene-3,20-dione</p>	Effective against menstrual disorders, infertility, threatened and habitual abortion.	Davis S.et.al [31]
<p>Estetrol</p>  <p>(8R,9S,13S,14S,15R,16R,17R)-13-methyl-6,7,8,9,11,12,14,15,16,17-decahydrocyclopenta[a]phenanthrene-3,15,16,17-tetrol</p>	Use of E4 as a marker for fetal well-being	Hagen A.A.et.al [32]
<p>Estradiol</p>  <p>(17β)-estra-1,3,5(10)-triene-3,17-diol</p>	Used in combined oral contraceptive pills	Wu CH.et.al [33]
<p>Estradiol acetate</p>  <p>(17β)-3-hydroxyestra-1,3,5(10)-trien-17-yl acetate</p>	Used to treat and prevent symptoms of menopause such as osteoporosis in postmenopausal women	Speroff L.et.al [34]
<p>Estradiol benzoate</p>	It was the first form of estrogen to be marketed	Roberts A. D.et.al [35]

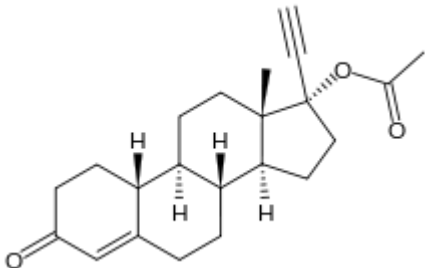
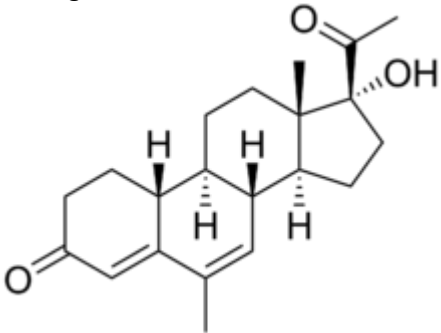
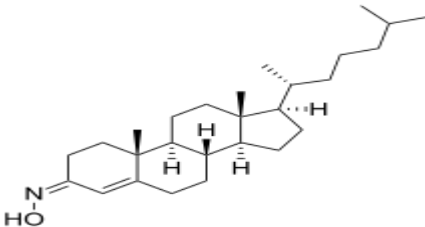
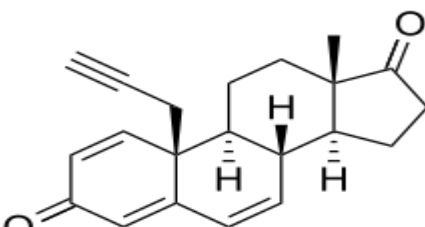
 <p>(17β)-17-hydroxyestra-1,3,5(10)-trien-3-yl benzoate</p>		
<p>Estramustine</p>  <p>(17β)-17-Hydroxyestra-1(10),2,4-trien-3-yl bis(2-chloroethyl)carbamate</p>	<p>Used to treat prostate cancer</p>	<p>H. J.et.al [36]</p>
<p>Estradiol undecylate</p>  <p>(17β)-3-hydroxyestra-1,3,5(10)-trien-17-yl undecanoate</p>	<p>Formerly used to treat prostate cancer</p>	<p>Christoph Zink .et.al [37]</p>
<p>Estradiol enanthate</p>  <p>(17β)-3-hydroxyestra-1,3,5(10)-trien-17-yl heptanoate</p>	<p>Used as injectable hormonal contraceptive</p>	<p>Roberts A.D.et.al [38]</p>
<p>Ethinyl estradiol</p>  <p>19-nor-17α-pregna-1,3,5(10)-trien-20-yne-3,17-diol</p>	<p>Used in many formulations of combined oral contraceptive pills</p>	<p>Walter .et.al [39]</p>
<p>Estrone sulfate</p>  <p>[(8R,9S,13S,14S)-13-methyl-17-oxo-7,8,9,11,12,14,15,16-</p>	<p>Used as a prognosis indicator for prostate cancer.</p>	<p>Horne C.et.al [40]</p>

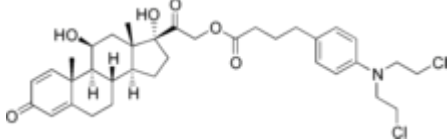
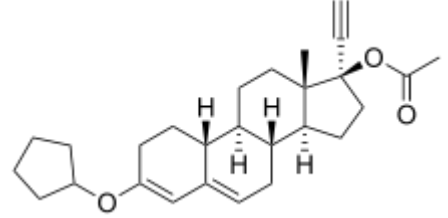
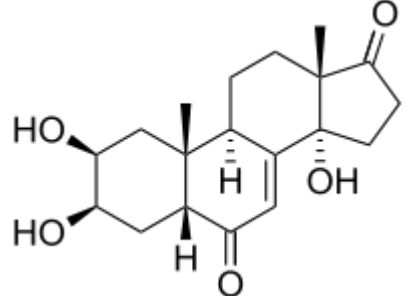
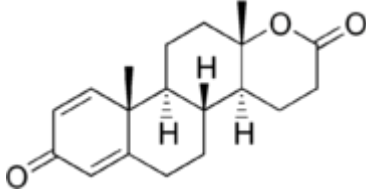
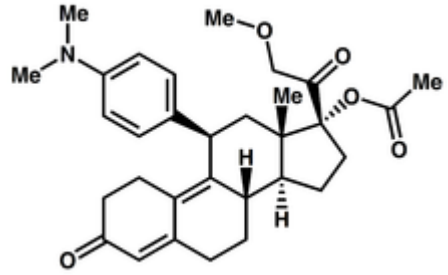
<p>octahydro-6H-cyclopenta[a]phenanthren-3-yl] hydrogen sulfate</p>		
<p>Etinodiol</p>  <p>(3β,17β)-17-ethynylestr-4-ene-3,17-diol</p>	<p>Used in hormonal contraceptives</p>	<p>Macdonald.et.al [41]</p>
<p>Etinodiol diacetate</p>  <p>(3β,17β)-17-ethynylestr-4-ene-3,17-diyl diacetate</p>	<p>Used in hormonal contraceptives</p>	<p>Macdonald.et.al [41]</p>
<p>Finasteride</p>  <p>N-(1,1-dimethylethyl)-3-oxo-(5α,17β)-4-azaandrost-1-ene-17-carboxamide</p>	<p>It is approved for the treatment of benign prostatic hyperplasia (BPH) and male pattern baldness (MPB).</p>	<p>Edwards.et.al [42]</p>
<p>Flumedroxone</p>  <p>(2R,8S,14S,15S)-14-acetyl-14-hydroxy-2,15-dimethyl-8-(trifluoromethyl)tetracyclo[8.7.0.0^{2,7}.0^{11,15}]heptadec-6-en-5-one</p>	<p>Used to treat migraines</p>	<p>Bradley W.G.et.al [43]</p>
<p>Fulvestrant</p>  <p>(7α,17β)-7-{9-[(4,4,5,5,5-pentafluoropentyl)sulfinyl]nonyl}estra-1,3,5(10)-triene-3,17-diol</p>	<p>Used treatment of hormone receptor-positive metastatic breast cancer in postmenopausal women</p>	<p>S. Kansra.et.al [44]</p>
<p>Fusidic acid</p>	<p>bacteriostatic antibiotic</p>	<p>Falagas ME.et.al [45]</p>

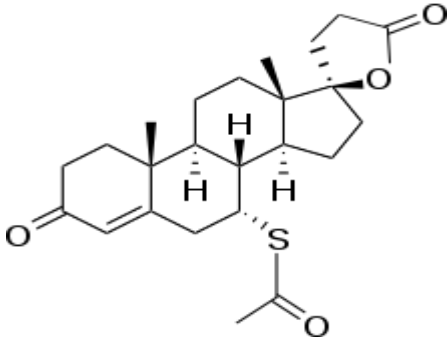
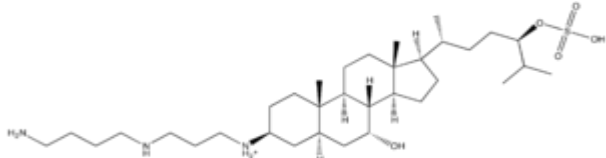
 <p>2-[(1S,2S,5R,6S,7S,10S,11S,13S,14Z,15R,17R)-13-(acetyloxy)-5,17-dihydroxy-2,6,10,11-tetramethyltetracyclo[8.7.0.0^{2,7}.0^{11,15}]heptadecan-14-ylidene]-6-methylhept-5-enoic acid</p>		
<p>Gestrinone</p>  <p>13-ethyl-17alpha-hydroxy-18,19 dinorpregna-4,9,11-trien-20-yn-3-one</p>	<p>Used for treatment of endometriosis</p>	<p>Tamaya T.et.al [46]</p>
<p>Guggulsterone</p>  <p>(8R,9S,10R,13S,14S)-17-Ethylidene-10,13-dimethyl-1,2,6,7,8,9,11,12,14,15-decahydrocyclopenta[a]phenanthrene-3,16-dione</p>	<p>Guggulsterone is an ingredient in many nutritional supplements.</p>	<p>Szapary P.O.et.al [47]</p>
<p>Lumisterol</p>  <p>(3S,9R,10S,13R,14R,17R)-17-[(E,2R,5R)-5,6-Dimethylhept-3-en-2-yl]-10,13-dimethyl-2,3,4,9,11,12,14,15,16,17-decahydro-1H-cyclopenta[a]phenanthren-3-ol</p>	<p>Lumisterol is a compound that is part of the vitamin D family of steroid compounds</p>	<p>Dewick.et.al [48]</p>
<p>Medrogestone</p>  <p>6,17-dimethylpregna-4,6-diene-3,20-dione</p>	<p>A hormone involved in the menstrual cycle and pregnancy</p>	<p>Goodman.et.al [49]</p>
<p>Medroxyprogesterone acetate</p>	<p>It is used as a contraceptive, in hormone replacement therapy and for the treatment of endometriosis</p>	<p>Schindler A.E.et.al [50]</p>

 <p>17α-hydroxy-6α-methylpregn-4-ene-3,20-dione acetate</p>		
<p>Megestrol</p>  <p>17-hydroxy-6-methylpregna-4,6-diene-3,20-dione</p>	<p>Used as a pharmaceutical drug.</p>	<p>Macdonald.et.al [41]</p>
<p>Megestrol acetate</p>  <p>17-(acetyloxy)-6-methyl-pregna-4,6-diene-3,20-dione</p>	<p>Used as an antineoplastic agent in the treatment of breast, endometrial, and prostate cancers</p>	<p>Schindler A.E.et.al [50]</p>
<p>Melengestrol</p>  <p>17-hydroxy-6-methyl-16-methylenepregna-4,6-diene-3,20-dione</p>	<p>Used as a growth promoter in animals</p>	<p>Macdonald.et.al [41]</p>
<p>Melengestrol acetate</p>  <p>17-hydroxy-6-methyl-16-methylenepregna-4,6-diene-3,20-dione acetate</p>	<p>Used as a feed additive to promote growth in cattle</p>	<p>David J.et.al [51]</p>
<p>2-Methoxyestradiol</p>	<p>It has undergone Phase 1 clinical trials against breast cancer.</p>	<p>Lakhani N.et.al [52]</p>

 <p>(8R,9S,13S,14S,17S)-2-methoxy-13-methyl-6,7,8,9,11,12,14,15,16,17-decahydrocyclopenta[a]phenanthrene-3,17-diol</p>		
<p>Methylestrenolone</p> 	<p>It is an anabolic steroid</p>	<p>Calvet D.et.al [53]</p>
<p>Minamestane</p>  <p>4-aminoandrosta-1,4,6-triene-3,17-dione</p>	<p>Act as antineoplastic agent</p>	<p>Macdonald.et.al [41]</p>
<p>Nestorone</p>  <p>(17α)-17-acetyl-16-methylene-3-oxoestr-4-en-17-yl acetate</p>	<p>Used as a hormonal contraceptive</p>	<p>Lippincott.et.al [54]</p>
<p>Norethynodrel</p>  <p>(8S,9S,13S,14S,17S)-17-ethynyl-17-hydroxy-13-methyl-</p>	<p>Used as oral contraceptive</p>	<p>R. A.et.al [55]</p>

<p>1,2,4,6,7,8,9,11,12,14,15,16-dodecahydrocyclopenta[<i>a</i>]phenanthren-3-one</p>		
<p>Norethisterone acetate</p>  <p>(8<i>R</i>,9<i>S</i>,10<i>R</i>,13<i>S</i>,14<i>S</i>,17<i>S</i>)-17-ethynyl-13-methyl-3-oxo-2,3,6,7,8,9,10,11,12,13,14,15,16,17-tetradecahydro-1H-cyclopenta[<i>a</i>]phenanthren-17-yl acetate</p>	<p>Used as a hormonal contraceptive</p>	<p>Macdonald.et.al [41]</p>
<p>Nomegestrol</p>  <p>(17α)-17-acetyl-17-hydroxy-6-methylestra-4,6-dien-3-one</p>	<p>hormonal contraceptive</p>	<p>Macdonald.et.al [41]</p>
<p>Olesoxime</p>  <p>(<i>NZ</i>)-<i>N</i>-[(8<i>S</i>,9<i>S</i>,10<i>R</i>,13<i>R</i>,14<i>S</i>,17<i>R</i>)-10,13-dimethyl-17-[(2<i>R</i>)-6-methylheptan-2-yl]-1,2,6,7,8,9,11,12,14,15,16,17-dodecahydrocyclopenta[<i>a</i>]phenanthren-3-ylidene]hydroxylamine</p>	<p>Undergoing a phase II clinical trial as treatment for spinal muscular atrophy.</p>	<p>Martin L.J .et.al [56]</p>
<p>Plomestane</p>  <p>10<i>H</i>-(2-propynyl)-estr-4-ene-3,17-dione</p>	<p>antineoplastic agent for the treatment of breast cancer.</p>	<p>Macdonald.et.al [41]</p>
<p>Prednimustine</p>	<p>Prednimustine is a drug used in</p>	<p>Monnerat C.et.al</p>

 <p>(11β)-11,17-dihydroxy-3,20-dioxopregna-1,4-dien-21-yl 4-[4-bis(2-chloroethyl)amino]phenyl]butanoate</p>	chemotherapy	[57]
<p>Quingestanol acetate</p>  <p>(17β)-3-(Cyclopentyloxy)-17-ethynylestra-3,5-dien-17-yl acetate</p>	Used as postcoital hormonal contraceptive	Giannina T.et.al [58]
<p>Rubrosterone</p>  <p>2β,3β,14α-trihydroxy-5β-androst-7-ene-6,17-dione</p>	hypolipidemic agent in rats	Geetha.et.al [59]
<p>Testolactone</p>  <p>(4aS,4bR,10aR,10bS,12aS)-10a,12a-dimethyl-3,4,4a,5,6,10a,10b,11,12,12a-decahydro-2H-naphtho[2,1-f]chromene-2,8(4bH)-dione</p>	Antineoplastic agent	Dunkel L.et.al [60]
<p>Telapristone</p>  <p>[(8S,11R,13S,14S,17R)-11-[4-(Dimethylamino)phenyl]-17-(2-methoxyacetyl)-13-methyl-3-oxo-</p>	Tested for treatment of progesterone sensitive myomata	Attardi B.J.et.al [61]

1,2,6,7,8,11,12,14,15,16-decahydrocyclopenta[σ]phenanthren-17-yl] acetate		
<p>Spirolactone</p>  <p>7α-acetylthio-3-oxo-17α-pregn-4-ene-21,17-carbolactone</p>	Used as a diuretic and antihypertensive	Brittain.et.al [62]
<p>Squalamine</p>  <p>(1S,2S,5S,7R,9R,10R,11S,14R,15R)-N-{3-[(4-aminobutyl)amino]propyl}-9-hydroxy-2,15-dimethyl-14-[(2R,5R)-6-methyl-5-(sulfooxy)heptan-2-yl]tetracyclo[8.7.0.0^{2,7}.0^{11,15}]heptadecan-5-aminium</p>	Broad-spectrum antibiotic	Moore K .S.et.al [63]

CONCLUSION

The reviewed Steroid moiety has shown a wide spectrum of biological activities. The various substitute steroid are having significant antihypertensive activity., Significant ,antineoplastic and veterinary drugs. some modified steroid are found to be effective as oral contraceptive, hormonal contraceptive, whereas some of the derivatives of steroid are found to be effective as nutritional supplement, broad spectrum antibiotic, treatment of breast cancer, endometrial, and prostate cancers, used as a contraceptive, in hormone replacement therapy and for the treatment of endometriosis, growth promoter in animals. Recently it was proven that, some of the important marketed steroid nucleolus containing drug having different biological or pharmacological activity were discussed in table. The steroid nucleolus based pharmaceutical are rapidly becoming very important class of therapeutic agents and are likely to replace many existing organic based pharmaceuticals in the very near future. The steroid based pharmaceuticals will be produced on a large scale by modern drug Discovery Company by different research development processes and will become available commercially for therapeutic use. With the key benefits including favorable time to market and high rate of success in clinical trial compared with traditional pharmaceuticals due to diverse biological action with less toxicity, so in future therapeutic steroid drug will play vital role in the treatment of different diseases. The biological profiles of this new generation of steroid represent much progress with regard to the older compounds.

REFERENCES

- [1] Tokuyama T, Daly J, Witkop B, Karle IL, Karle J. *J Am Chem Soc* 1968; 90: 1917–1918.
- [2] Berger Artur, Wachter Helmut, eds. (in German). *Hunnius Pharmazeutisches Wörterbuch*. Walter de Gruyter Verlag. 1998; 8: 486.
- [3] Clarke RS, Dundee JW, Carson IW. *Proceedings of the Royal Society of Medicine* 1973; 66(10): 1027–1030.
- [4] Roberts AD. *Dictionary of Steroids: Chemical Data, Structures, and Bibliographies*. CRC Press. 1991; 336.
- [5] Sweetman, Sean C. "Sex hormones and their modulators". *Martindale: the complete drug reference*. London: Pharmaceutical Press 2009; 36: 2082.
- [6] Wyart C, Webster WW, Chen JH, Wilson SR, McClary A, Khan RM, Sobel N. *J Neurosci* 2007; 27 (6): 1261–5.
- [7] Adkins-Regan, Elizabeth; Cary H Leung. *Hormones and Behaviour* 2006; 50 (5): 772–778.
- [8] Chen F, Knecht K, Leu C, et al. *The Journal of Steroid Biochemistry and Molecular Biology* 2004; 91(4-5): 247–57.
- [9] Whitnall MH, Elliott TB, Harding RA et al. *Int J Immunopharmacol* 2000; 22 (1): 1–14.
- [10] Kirk-Smith MD, Booth DA, Carroll D and Davies P. *Research Communications in Psychology, Psychiatry and Behaviour* 1978; 3: 379- 384.
- [11] Kirk-Smith MD and Booth DA. "Effect of androstenone on choice of location in others' presence". In H. van der Starre (Ed.), *Olfaction and Taste VII*, London: Information Retrieval Ltd 1980; 397-400.
- [12] JG Reid, T Debiak-Krook. *Tetrahedron Lett* 1990; 31: 3669.
- [13] El Etreby MF. *J Steroid Biochem Mol Biol* 1993; 44(4-6): 565–72.
- [14] Chu CC, Chen KC, Diao GY. *J Urol* 1999; 162 (3-1): 861–3.
- [15] Grove MD, Spencer GF, Rohwedder WK, Mandava N, Worley JF, Warthen JD, Ste€ens GL, Flippen-Anderson JL and Cook JC. *Nature* 1979; 225(5237): 1065–66.
- [16] Savage PB, Li C, Taotafa U, Ding B, Guan Q. (2002-11-19). "Antibacterial properties of cationic steroid antibiotics.
- [17] F Macdonald. *Dictionary of Pharmacological Agents*. CRC Press 1997; 419.
- [18] Hanukoglu I. *J Steroid Biochem Mol Biol* 1992; 43 (8): 779–804.
- [19] Garg S, Bhutani KK. *Phytochemical Analysis*. 2008; 19(4):323-8.
- [20] Mudge SM & Ball AS. Morrison R and Murphy B ed. *Sewage In: Environmental Forensics: A Contaminant Specific Approach*. Elsevier 2006; 533.
- [21] Aoki S, Watanabe Y, Sanagawa M, Setiawan A, Kotoku N, Kobayashi M. *J American Chem Soc* 2006; 128 (10): 3148–9.
- [22] Peterson DH, Murray HC. *J Am Chem Soc* 1952; 74(7): 1871–2.
- [23] Di Prisco CL, Materazzi G, Scattolini B. *Gynecolog Invest* 1971; 2(1): 309–315.
- [24] *Index Nominum 2000: International Drug Directory*. Taylor & Francis US. 2000; 289.
- [25] Neumann F, Töpert M. *Journal of Steroid Biochemistry* 1986; 25 (5B): 885–95.
- [26] Dmowski WP, Scholer HF, Mahesh VB, Greenblatt RB. *Fertil Steril* 1971; 22(1): 9–18.
- [27] Rainey WE, Nakamura Y. *J Steroid Biochem Mol Biol* 2008; 108 (3-5): 281–6.

- [28] F Macdonald. Dictionary of Pharmacological Agents. CRC Press 1997; 579.
- [29] Foster RH, Wilde MI. *Drugs* 1998; 56 (5): 825–33; discussion 834–5.
- [30] Djerassi C. *Steroids* 1992; 57 (12): 631–41.
- [31] Loose, Davis S, Stancel, George M. "Estrogens and Progestins". In Brunton, Laurence L.; Lazo, John S.; Parker, Keith L. (eds.). *Goodman & Gilman's The Pharmacological Basis of Therapeutics* (11th ed.). New York: McGraw-Hill. 2006; 1541–71.
- [32] AA Hagen, M Barr, E Diczfalusy. *Acta Endocrinol* 1965; 49: 207-220.
- [33] Wu CH, Motohashi T, Abdel-Rahman HA, Flickinger GL, Mikhail G. *J Clin Endocrinol Metab* 1976; 43 (2): 436–45.
- [34] Speroff L. *Obstetrics and Gynecology* 2003; 102 (4): 823–34.
- [35] AD Roberts. *Dictionary of Steroids: Chemical Data, Structures, and Bibliographies*. CRC Press. 1991; 414.
- [36] Fex H J, Hogberg KB, Konyves I, Kneip O J 1967.
- [37] Christoph Zink. *Dictionary of Obstetrics and Gynecology*. Walter de Gruyter 1988; 85.
- [38] AD Roberts. *Dictionary of Steroids: Chemical Data, Structures, and Bibliographies*. CRC Press 1991; 415.
- [39] Sneader, Walter. "Hormone analogues". *Drug discovery : a history*. Hoboken, NJ: John Wiley & Sons 2005; 188–225.
- [40] Horne C, Chew BP, Wiseman BS, Dziuk PJ. *Biol Reprod* 1983; 29 (1): 56–62.
- [41] F Macdonald. *Dictionary of Pharmacological Agents*. CRC Press. 1997; 1454.
- [42] Edwards, Jayne E, Moore, R Andrew. *BMC Urology* 2002; 2: 14.
- [43] Bradley WG, Hudgson P, Foster JB, Newell DJ. *Br Med J* 1968; 3 (5617): 531–3.
- [44] S Kansra, S Yamagata, L Sneade, L Foster & N Ben-Jonathan. *Mol Cell Endocrinol* 2005; 239 (1-2): 27–36.
- [45] Falagas ME, Grammatikos AP, Michalopoulos A. *Expert Rev Anti Infect Ther*. 2008; 6(5):593-600.
- [46] Tamaya T, Fujimoto J, Watanabe Y, Arahori K & Okada H. *Acta obstetrica et gynecologica Scandinavica* 1986; 65 (5): 439–41.
- [47] Szapary PO, Wolfe ML, Bloedon LT, Cucchiara AJ, Dermarderosian AH, Cirigliano MD, Rader DJ. *JAMA* 2003; 290 (6): 765–772.
- [48] Dewick, Paul M. *Medicinal Natural Products. A Biosynthetic Approach*, New York: John Wiley & Sons, 2002; 2: 259.
- [49] *Goodman & Gilman's The Pharmacological Basis of Therapeutics*. New York: McGraw-Hill 11 ed: 1541–73.
- [50] Schindler AE, Campagnoli C, Druckmann R, Huber J, Pasqualini JR, Schweppe KW, Thijssen JH. *Maturitas* 2008; 61 (1-2): 171–80.
- [51] David J Triggle. *Dictionary of pharmacological agents*. London: Chapman & Hall. 1997; 1269.
- [52] Lakhani NJ, Sarkar MA, Venitz J, Figg WD. *Pharmacotherapy* 2003; 23 (2): 165–72.
- [53] Begni-Calvet D. *Gynecologie pratique* 1959; 10: 261–272.
- [54] Foye's *Principles of Medicinal Chemistry*. Lippincott Williams & Wilkins. 1403.
- [55] Edgren RA. *Steroids* 1994; 59 (1): 58–59.
- [56] Martin LJ. *IDrugs* 2010; 13 (8): 568–80.



- [57] Monnerat C, Gander M, Leyvraz S. *J Natl Cancer Inst* 1997; 89 (2): 173–4.
- [58] Giannina T, Steinetz BG, Rassaert CL, McDougall EA, Meli A. *Society for Experimental Biology and Medicine* 1969; 131 (3): 781–9.
- [59] G Geetha, KG Prasanth, B Samuel Thavamani, AR Prudence, V Hari Bhaskar. Hypolipidemic activity of *achyranthes rubrofuscus* linn. Whole plant extracts in high fat diet induced hyperlipidemic rats. Department of Chemistry, PSG College of Pharmacy, Peelamedu, Coimbatore 641 004, Tamil Nadu, India.
- [60] Dunkel L. *Mol Cell Endocrinol* 2006; 254-255: 207–16.
- [61] Attardi BJ, Burgenson J, Hild SA, Reel JR. *J Steroid Biochem Mol Biol* 2004; 88 (3): 277–88.
- [62] Harry G. Brittain. *Analytical Profiles of Drug Substances and Excipients*. Academic Press. 2002; 309.
- [63] Moore KS, S Wehrli, H Roder, M Rogers, JN Forrest, D McCrimmon, M Zasloff. *Proceedings of the National Academy of Sciences of the United States of America* 1993; 90 (4): 1354–8.