

## B-Steroid hormones (sex hormones)

### Hormones :

1-**Hormones** are substances which are secreted by the ductless glands ,and only minute amounts are necessary to produce the various physiological reactions in the body.

2-As a group ,hormones do not resemble one another chemically ,and their classification is based on their physiological activity.

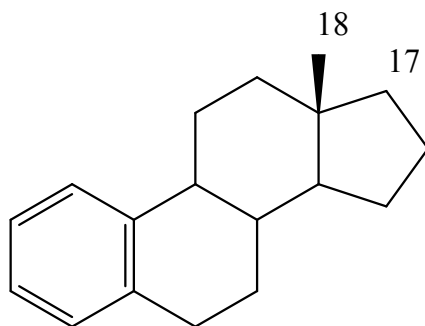
3-The sex hormones belong to the steroid class of compounds ,and are produced in glands (tests in the male ,and ovaries in the female).

4-Their activity appears to be controlled by the hormones that are produced in the anterior lobe of the pituitary gland.

5-Because of this ,the sex hormones are sometimes called the secondary sex hormones and the hormones of the anterior lobe of the pituitary (which are protein in nature ) are called the primary sex hormones .

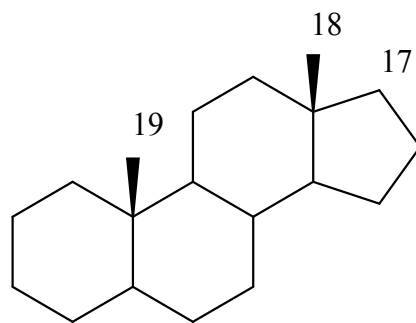
6-They are classified into :

a-**Oestrogens**: Female hormones or follicular hormones) and their parent hydrocarbon is called oestrane (C<sub>18</sub>)



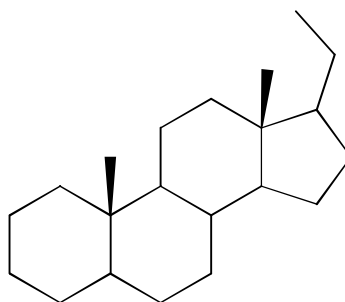
oestrane

b-**Androgens** :Male hormones and their parent hydrocarbon is called androstane (C<sub>19</sub>)



androstane

c-**Gestogens** :They are the corpus luteum hormones and their parent hydrocarbon is called pregnane(C<sub>21</sub>)

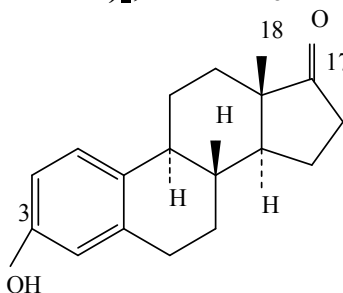


pregnane

7-The sex hormones are responsible for the sexual processes, and for the secondary characteristics which differentiate males from females.

### a-Oestrogens

1-Oestrone ( estrone); M.F. C<sub>18</sub>H<sub>22</sub>O<sub>2</sub> ; m.p.259°C



1-It was isolated from the urine of pregnant women.

2-It behaves as a ketone ( forms mono oxime ,monohydrazone with hydroxyl amine and hydrazine respectively.

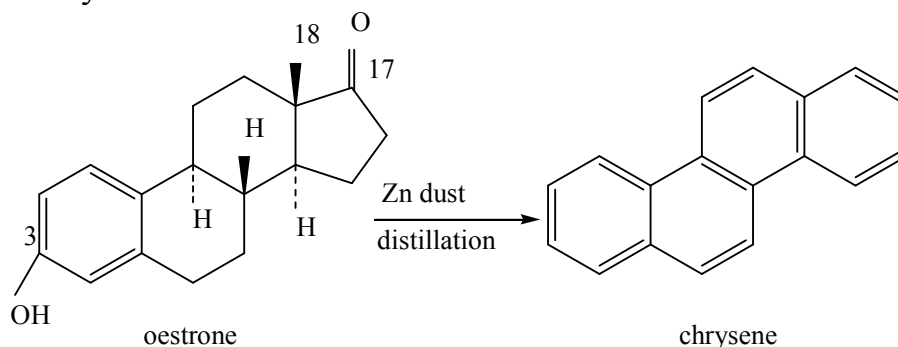
3-It contains one hydroxyl group since,

a-It forms a monoether with methyl iodide

b-It forms a monoacetate with acetic anhydride

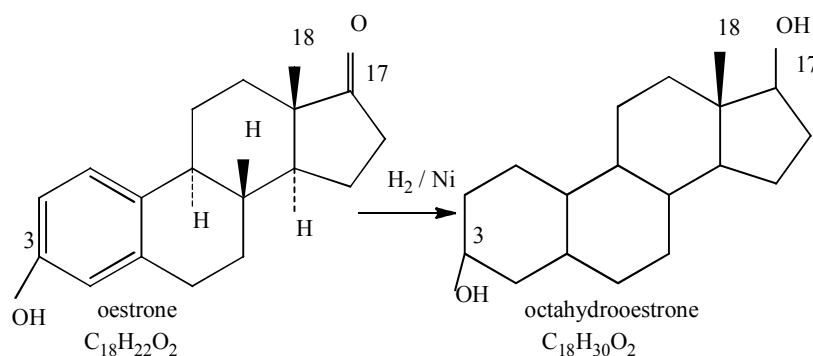
c-This hydroxyl group is aromatic ( phenolic ) ,since it couples  $\text{ArN}_2^+\text{Cl}^-$  in an alkaline solution and gives a color with  $\text{FeCl}_3$  .

4-Oestrone forms chrysene when distilled with zinc.



This leads to the suggestion that oestrone is related to the steroids and there is one angular methyl group at C-13.

5-On catalytic hydrogenation,oestrone forms octahydrooestrone , $\text{C}_{18}\text{H}_{30}\text{O}_2$  .

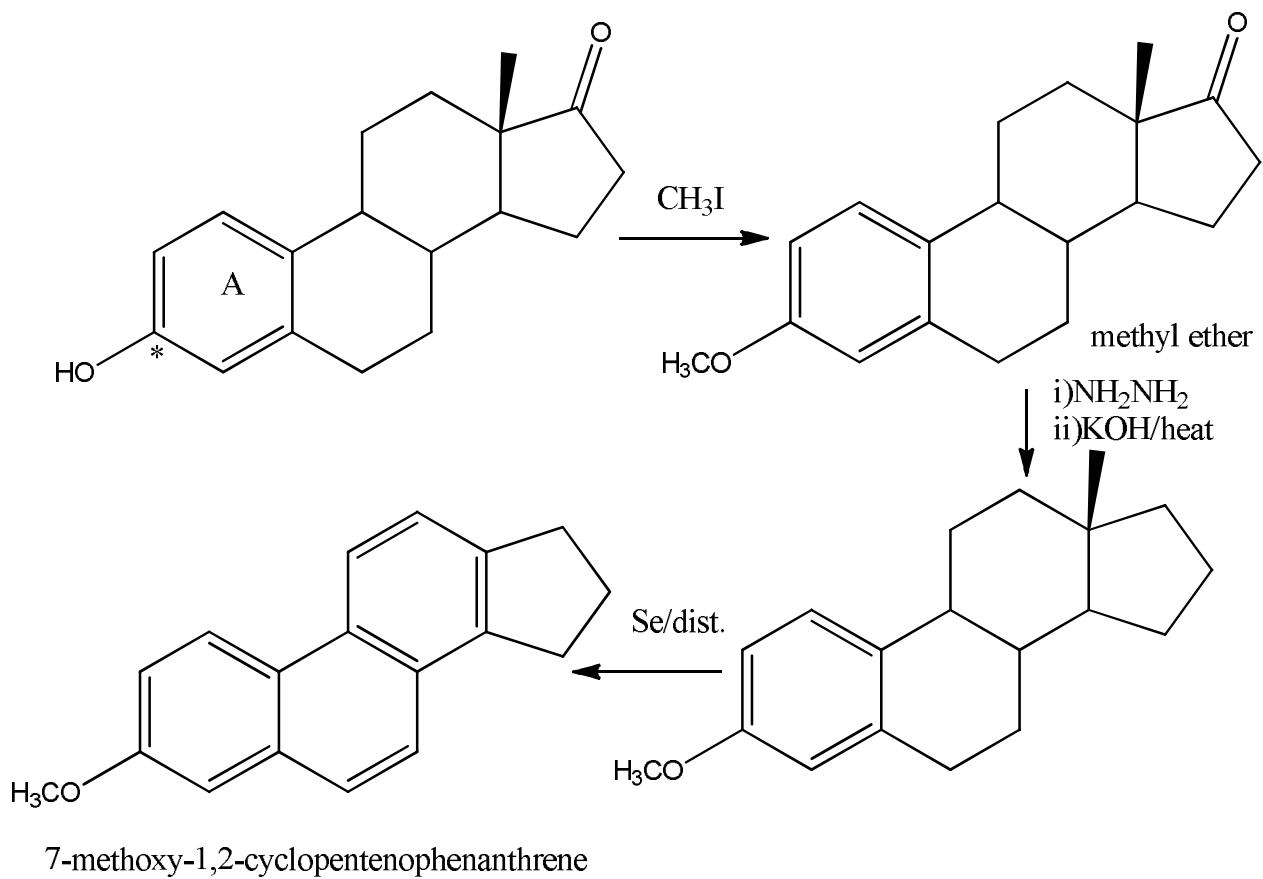


This reaction indicates that oestrone contains three double bonds (in the benzene ring) and one carbonyl group because it absorbs four hydrogen molecules ,

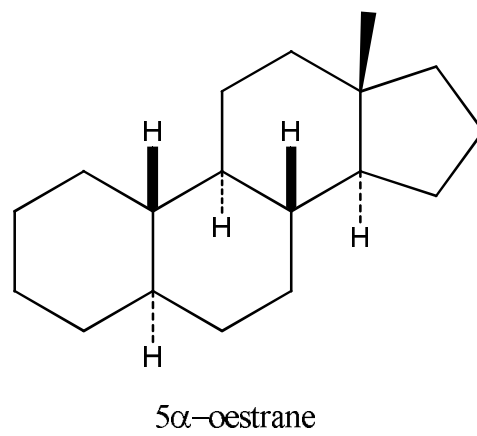
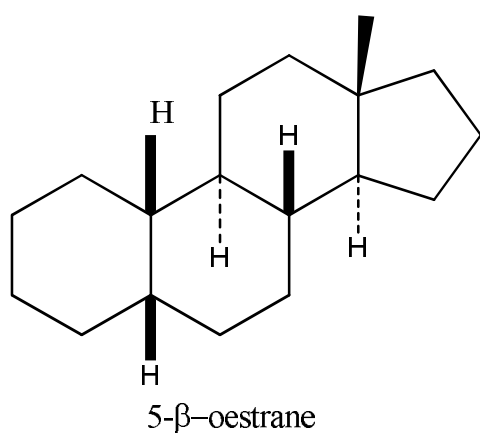
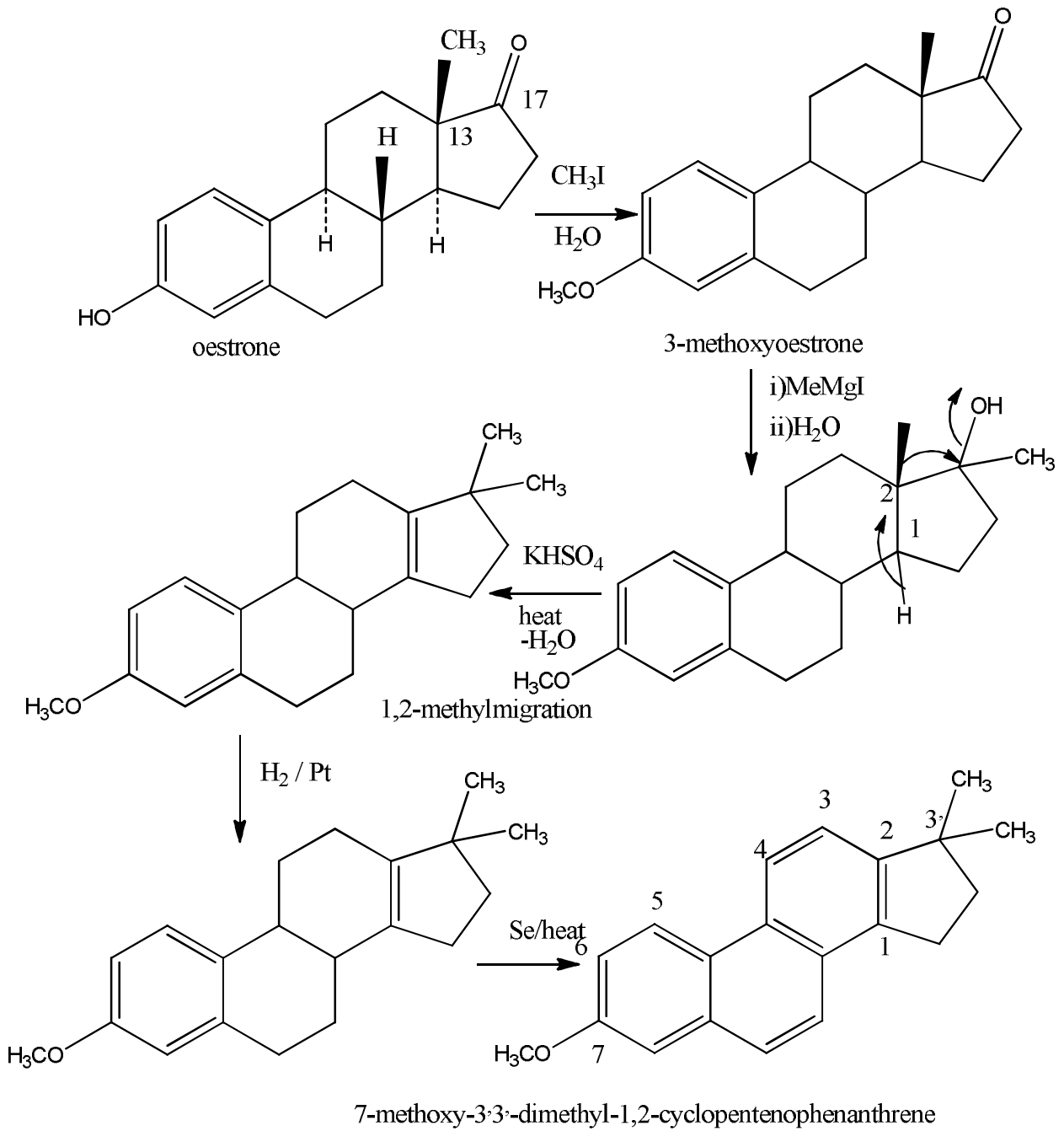
Thus, its parent hydrocarbon with M.F. $\text{C}_n\text{H}_{2n-6}$  ,consequently, oestrone is tetracyclic .

6-When the methyl ether of oestrone is subjected to the Wolf-kishner reduction ,and the product distilled with selenium ,7-methoxy-1,2-cyclopentenophenanthrene is formed .

This is to indicate that the benzene ring is the ring A and the hydroxyl group at position 3 (at C-3) in the ring A.

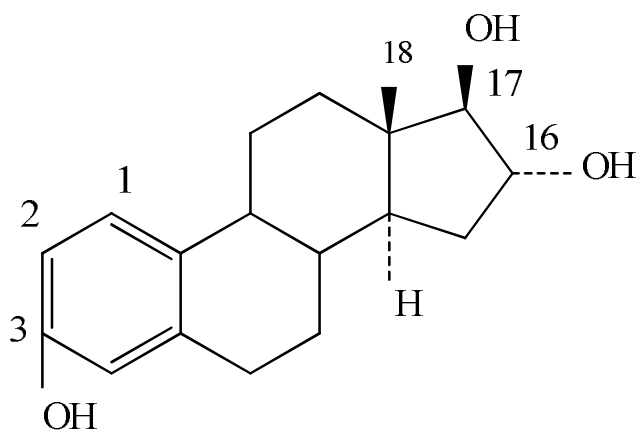


8-To indicate that there is a keto group at C-17 ; and there is an angular methyl at C-13 .



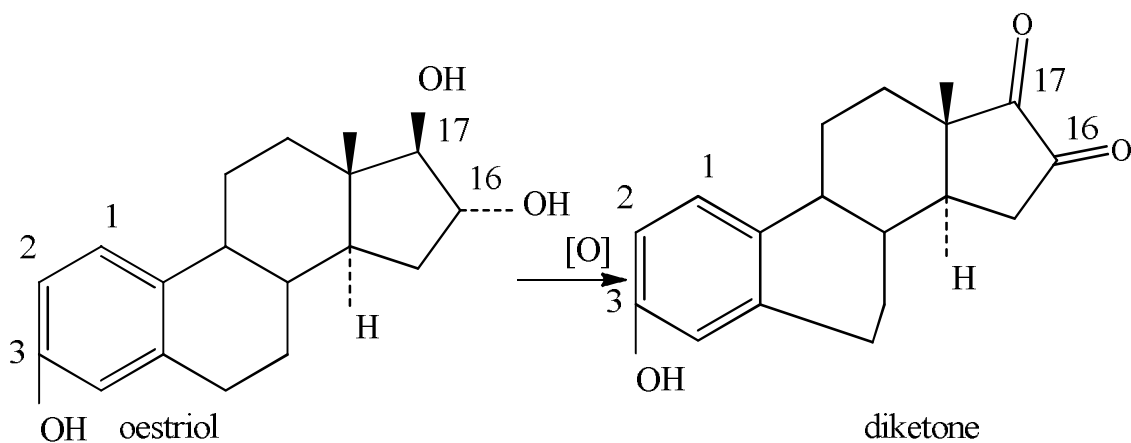
## 2- Oestriol

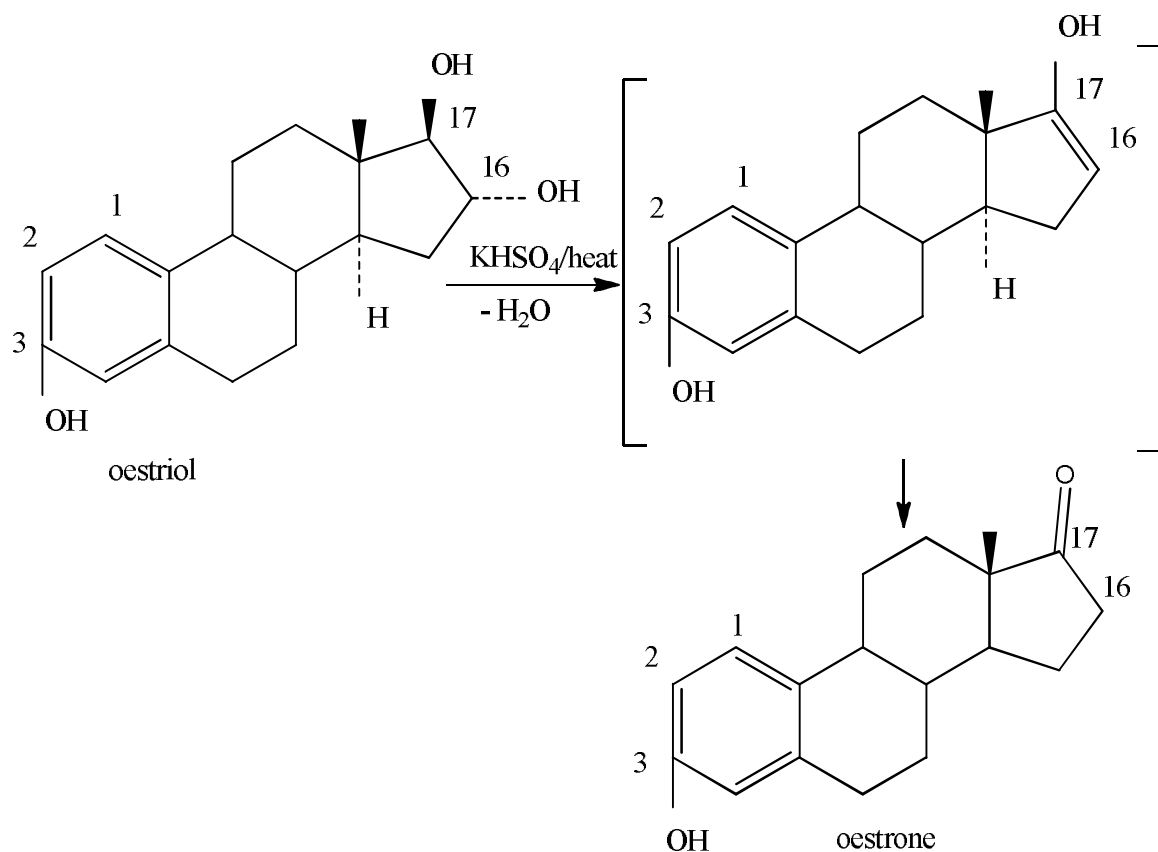
M.F.C<sub>18</sub>H<sub>24</sub>O<sub>3</sub> ,was isolated from human pregnancy urine



Since it forms a triacetate , three hydroxyl groups must be present in the molecule .

One hydroxyl group was shown to be phenolic from its reactions and the other two hydroxyl groups are secondary alcoholic , since on oxidation a diketone is produced .

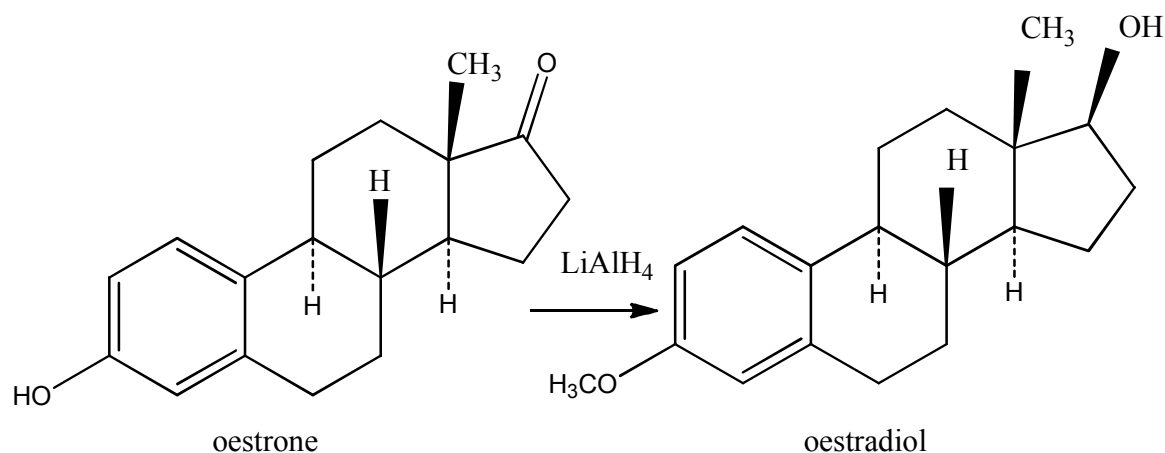




It therefore follows that oestriol has the same carbon skeleton as oestrone, and that the two alcoholic groups in oestriol are at positions 16 and 17 and the phenolic OH at C-3.

The chemical relationship between oestrone, oestriol and oestradiol is shown by the following reactions:

1-Oestrone may be reduced by catalytic hydrogenation, by aluminium isopropoxide (Meerwein-Ponndorf-Verley reduction), or by LiAlH<sub>4</sub>.

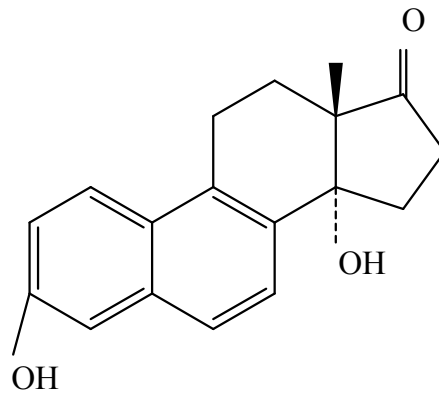


2-Oestriol may be converted into oestrone by the action of KHSO<sub>4</sub> and oestrone may be converted into oestriol as follows:

Oestriol is more soluble than oestrone in water, and is more potent than either oestrone or oestradiol when taken orally.

### 3- Equilenin

M.F.  $C_{18}H_{18}O_2$



1-It was isolated from the urine of pregnant mares

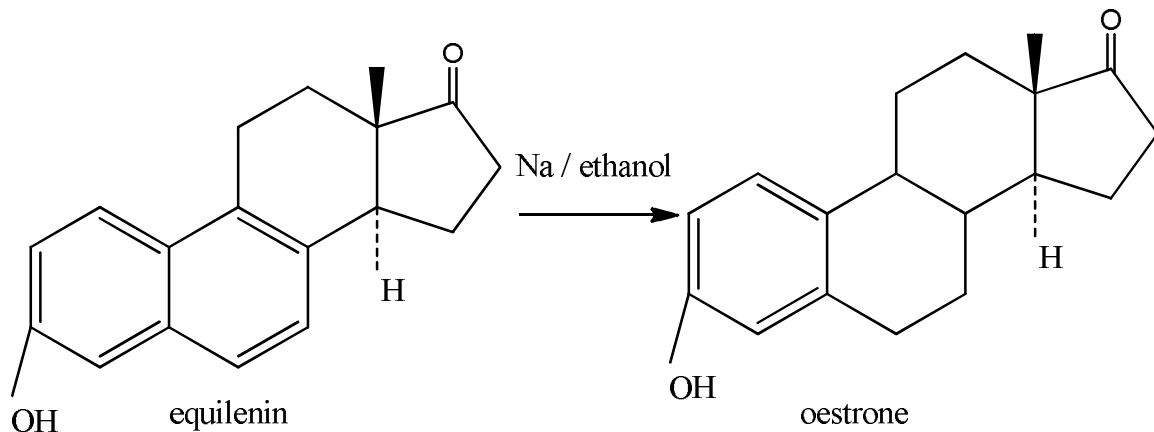
إناث الخيل

From its reactions, there is a carbonyl ketonic group by condensation with hydroxylamine and hydrazine.

2-Also, it contains a phenolic hydroxyl group since it gives a color with  $FeCl_3$ .

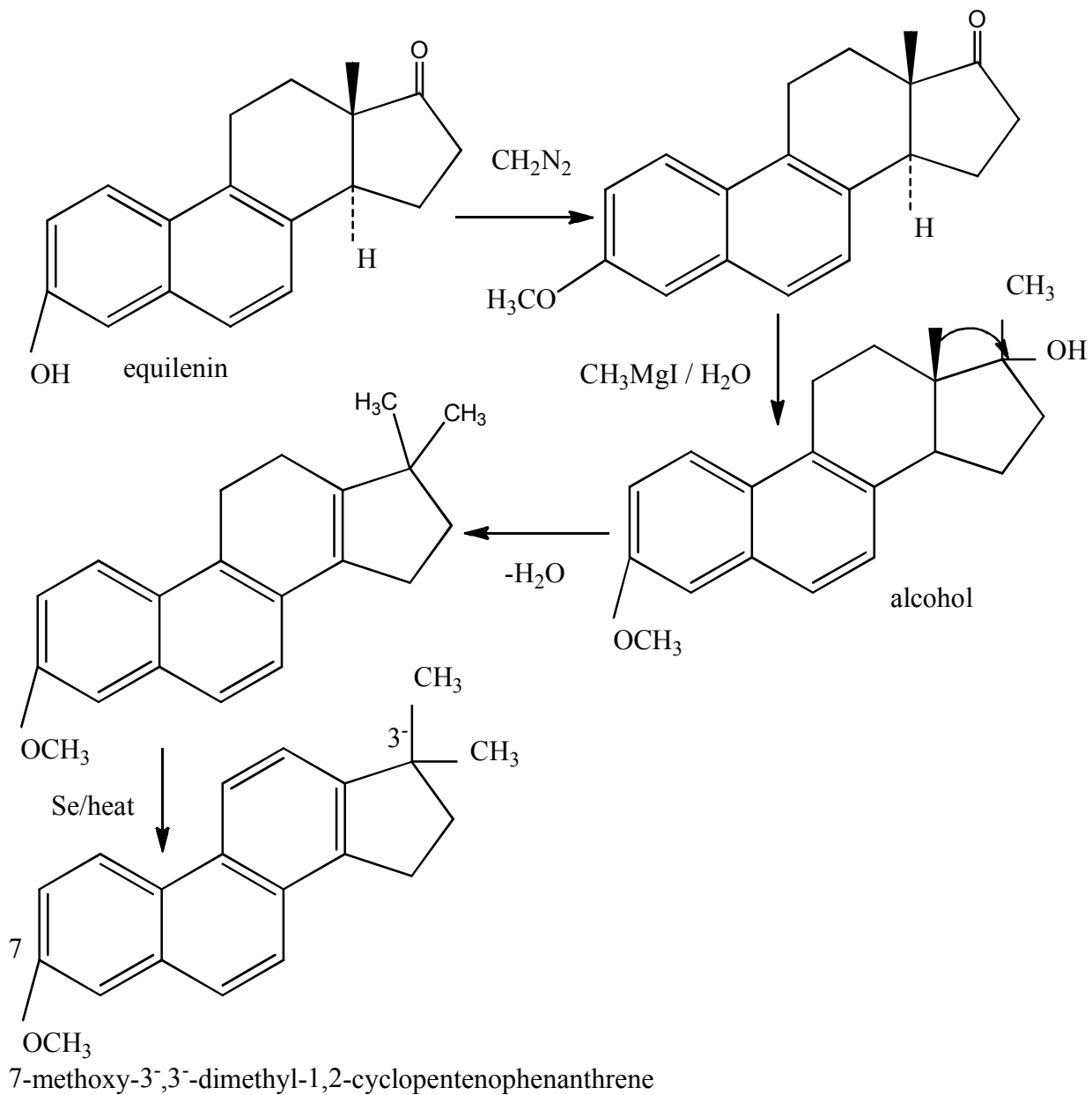
3-In addition, the molecule contains five double bonds and one carbonyl group, since it absorbs six hydrogen molecules on catalytic hydrogenation.

4-It has the same structure as oestrone, since it can be converted into oestrone, but Equilenin has five double bonds and oestrone has three double bonds.



It also contains an angular methyl at C-18 and a five-membered ring from these reactions.





4- ***Equilin***; M.F.  $\text{C}_{18}\text{H}_{20}\text{O}_2$ , has also isolated from the urine of pregnant mares.

