**ABSTRACT**

Follicular stimulating hormone (FSH) plays an essential role in ovarian folliculogenesis and estrogen production. Recently, extragonadal expression of FSH receptor (FSHR)   
has been shown in human endometrium, fallopian tube, cervix, myometrium, placenta, human umbilical cord endothelial cells, osteoclasts, and tumor endothelial cells   
of different human cancers. In this study, FSHR expression in deep endometriotic nodules, ovarian endometrioma and normal endometrium, as well as the potential role   
of FSH in local endometriotic estrogen biosynthesis was examined. An expression profile   
of aromatase, estrogen receptors and genes of transcription factors typical for gonads   
i.e. GATA4, GATA6, FOG2 and SF1 in endometriotic tissues and normal endometrium was also studied. For *in vitro* studies, patient derived endometriotic tissue explants were used. FSHR expression was found in endometriotic lesions and normal secretory phase endometrium at both mRNA and protein levels. In deep endometriotic nodules   
and ovarian endometriomas, *CYP19A1* was significantly upregulated compared to normal endometrium. Explants of deep endometriotic nodules also demonstrated significantly   
up-regulated *CYP19A1* thatwas activated by the CYP19A1 proximal promoter II (PII).   
Deep endometriotic nodules compared to normal endometrium displayed significantly upregulated estrogen receptor β (*ESR2*) at mRNA level and abundant ERβ protein. Moreover, expression levels of *GATA4, GATA6, ZFPM2* (FOG-2) and *NR5A1* (SF-1) were significantly higher in deep endometriotic nodules, ovarian endometriomas   
and normal ovary compared to normal endometrium. FSH stimulation significantly upregulated *CYP19A1* and *ESR2* expression, as well as estradiol production by the deep endometriotic nodule explants *in vitro*. *FSHR* was upregulated in FSH-stimulated endometrial and decidualized stromal cells, which displayed upregulated *CYP19A1* expression. Hereby, a novel functional FSHR expression, FSH-stimulated *CYP19A1*   
and *in vitro* local estrogen production by the deep endometriosis lesions was shown.   
This FSH-FSHR-CYP19A1\_PII mediated mechanism of local FSH-induced estrogen production may contribute to the molecular pathomechanisms of deep endometriosis.   
It is possible that the inhibition of gonadotropin secretion with systemic supplemental estrogen restoration may contribute to an optional treatment future strategy   
for endometriosis.