



Editorial

Physiology and Pathophysiology of the Placenta

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We are pleased to present this Special Issue of the *International Journal of Molecular Sciences*, entitled “Physiology and Pathophysiology of Placenta”.

Placentation is an important and tightly regulated process that ensures the development of placenta, allowing for the normal progression of the fetus. The placenta is an essential organ which plays different and fundamental functions during pregnancy, and its development is regulated by several growth factors, hormones, their receptors and many other types of molecules involved in the regulation of placental cell proliferation, differentiation, migration and invasion [1,2].

The correct function of these processes is tightly regulated by the activation or inhibition of several signalling pathways that regulate the expression of specific genes necessary for a successful pregnancy. The importance of normal placental development becomes evident in the case of impaired placental development, which can lead to significant pregnancy complications such as preeclampsia (PE) [3], fetal growth restriction (FGR) [4], gestational trophoblastic diseases (GTD) [5], preterm delivery [6,7] and gestational diabetes mellitus (GDM) [8]. Pregnancy can also be impaired by exposure to exogenous agents such as bacteria [7], viruses [9], chemicals and natural compounds [9,10] that can alter the normal placental functions, compromising pregnancy outcome. Many of the disorders/pathologies previously mentioned are associated with an increase in maternal and fetal mortality and morbidity, and can lead to life-long health complications for both mother and child.

Important signalling pathways such as Wnt/-catenin, TGF/SMAD, PI3K/AKT/mTOR and JAK/STAT pathways have been reported to be impaired in several pregnancy complications such as PE, GDM and FGR [10–13], which share an inflammatory and oxidative stress condition [6,8]. In addition to the previously mentioned pathologies, viral and bacterial infections during pregnancy can also lead to an increase in inflammatory cytokines that alter the normal function of the placenta and amniotic membranes, causing preterm delivery or significant neonatal complications [7,9,14]. All the pathologies already mentioned cause systemic inflammation (acute or chronic) that turns into endothelial dysfunction. Endothelial dysfunction impairs the normal functionality of the endothelium, and thus can alter the normal function of reproductive organs [15–18].

For these reasons, new and specific biomarkers are necessary in clinical practice to allow an early diagnosis of many of the above-mentioned pregnancy complications, in order to carry out early treatment of the pathology, improving the outcome of the pregnancy or resolving the pathology [8,19,20].

Several natural and synthetic compounds have shown important beneficial effects in treating several diseases. These compounds have also demonstrated important effects in pregnancy complications, suggesting a possible use of these compounds, alone or in combination with classical drugs, to treat these diseases, improving pregnancy outcomes [21,22].

Understanding the mechanisms involved in the regulation of human placenta development in normal and pathological conditions can help to open new perspectives in the treatment of these pregnancy complications.

Thus, the aim of this Special Issue is to provide an overview of the physiology and pathophysiology of the placenta, in order to better understand its development in normal and pathological conditions.



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