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PARP1 – Another factor of stemness?

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The pluripotency of embryonic stem cells, which are capable of unlimited self-renewal and differentiation into every type of cell in the body, is provided by the extensive expression of genes encoding stemness factors, among which the transcription factors such as Sox2, Pou5f1, Nanog are most frequently enumerated [1]. These proteins interact with specific sequences in the regulatory elements of cell type-specific and/or cell cycle regulating genes thereby rescuing cell from the differentiation process. Recent findings have shed the light on DNA-interacting genome guardian – PARP1, which might be considered as another player in the complex stemness game [2].

According to the published data PARP1 together with PARP7 sustains the pluripotency of embryonic stem cell by maintaining the active chromatin configuration (reduced H3K9me3 and H3K27me3 as well as DNA methylation) at promoters of *Nanog*, *Pou5f1*, *Sella* and *Zfp43[3]*. Thus, the lack of PARP1 favors the repression of pluripotency factors and the enhances retinoic acid-induced ES differentiation into derivatives off all three germ layers in embryoid bodies. Moreover, the reprograming of somatic cells into pluripotent stem cells (iPSCs) requires inter alia PARP1 recruitment to *Nanog* and *Esrrb* loci, where functions in the establishement of active chromatin state and facilitates the binding of Oct4 [4]. Another "for" comes from the observation that PARP1 augments expression of the proliferation-promoting fibroblast growth factor - FGF4 directly by the binding to FGF4 enhancer and indirectly by ADP-ribosylating Sox_2, what results in the dissociation of Sox2 from FGF4 upstream regulatory element in embryonic stem cells [5]. Furthermore, transcription of PARP1 was found to be downregulated during certain types of the differentiation such as myoblasts into myotubes differentiation [6]. The PARP1 repression was associated with the reduction of PCNA expression (marker of cell proliferation) and with the accumulation of myogenin (myogenesis-specific transcription factor). One may think that PARP1 repression may be prerequisite for the cell fate, but such far-reaching idea requires further verification.

Summing up, based on the premises acquired up to date PARP1 meets the criteria to be at least considered as another factor, which determines cell pluripotency and self-renewal.

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