Knowledge Systematization for Cellular Senescence Processes by Homeostasis Imbalance Process Ontology

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Abstract

In the science of aging, controlling cellular senescence attracts increasing attention. This study focuses on cellular senescence and systematizes knowledge by developing the homeostasis imbalance process ontology (HoIP). We uniformly represent a series of processes related to cellular senescence as an imbalance between stress and its response. Moreover, we show how cellular senescence brings benefits and deleterious effects in the embryonic, acute, and chronic course.

Keywords

cellular senescence, homeostasis imbalance process ontology, knowledge systematization

1. Introduction

Cellular senescence is a crucial factor in aging. This abstract introduces an organization of knowledge concerning the processes of cellular senescence. We have developed a homeostasis imbalance process ontology (HoIP) (https://bioportal.bioontology.org/ontologies/HOIP) [1]. We report the representation of the course of cellular senescence in HoIP.

2. Methods and Results

We manually reviewed textbooks and articles using Protégé 5.5.0. This work captured the process of cellular senescence as the outcome of homeostasis imbalance between stress (e.g., DNA damage) and stress response. Referring to upper ontology BFO and OBO-Foundry ontologies in biomedicine, we created a new definition of the course of cellular senescence in HoIP.

HoIP describes each course in terms of causal processes. For example, in the chronic cellular senescence course, we confirmed that sustained senescence-associated secretory phenotype (SASP) secretion could cause chronic inflammation related to oncogenesis and type 2 diabetes. In contrast, transient SASP might cause DNA repair, tissue repair, and tissue remodeling in the embryonic and acute courses.

3. Discussion

This study shows that cellular senescence benefits the embryonic and acute course via the homeostatic imbalance. Especially in embryos, the homeostatic imbalance might lead to dynamic equilibrium, i.e., homeorhesis [2]. This framework also highlights the fact that chronic cellular senescence has deleterious tissue effects. HoIP will aid in understanding the fundamental mechanisms of cellular senescence.

4. Acknowledgements

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5. References

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