Hallmarks of cancer and hallmarks of aging reviewed

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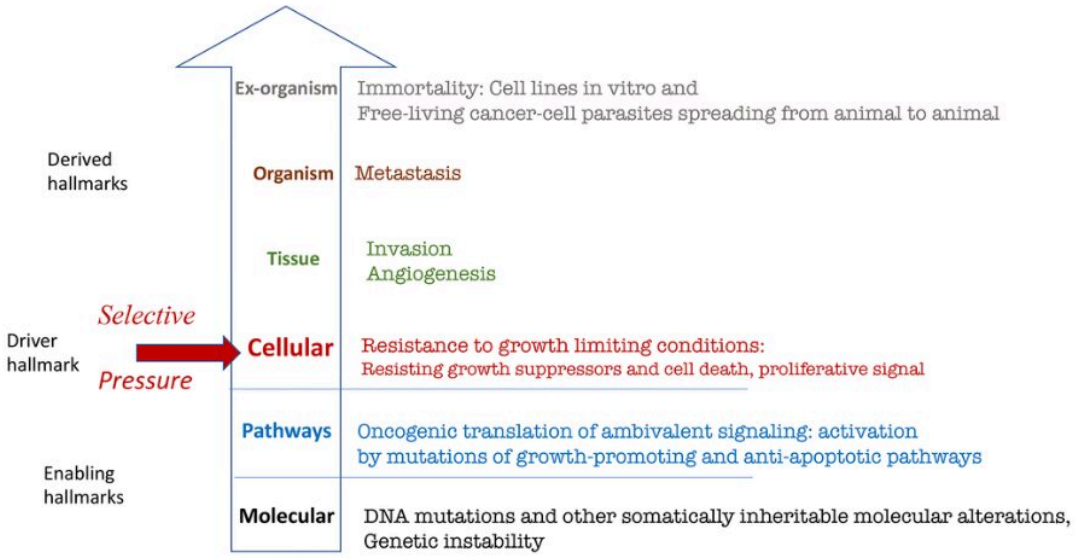

Figure 1. Hierarchical representation (from molecular to organismal levels) of the original hallmarks of cancer based on Hanahan and Weinberg. See text for explanation.

Hierarchical representation (from molecular to organismal levels) of the original hallmarks of cancer based on Hanahan and Weinberg. Credit: Aging-US.com

Dr. Mikhail Blagosklonny has published his new review paper titled "Hallmarks of cancer and hallmarks of aging" in *Aging* Volume 14, Issue 9.

In this review, Dr. Blagosklonny expands on the notion of Gems and de Magalhães that canonic hallmarks of aging are superficial imitations of the hallmarks of cancer. He takes their work a step further and proposes the hallmarks of cancer and aging based on a hierarchical principle and the hyperfunction theory, stating, "Here I present the hallmarks of cancer, depicted as a circle by Hanahan and Weinberg, not as the circle but hierarchically, from molecular levels to the organism."

Next, Dr. Blagosklonny depicts the hallmarks of aging suggested by López-Otín et al. based on the hierarchical principle.

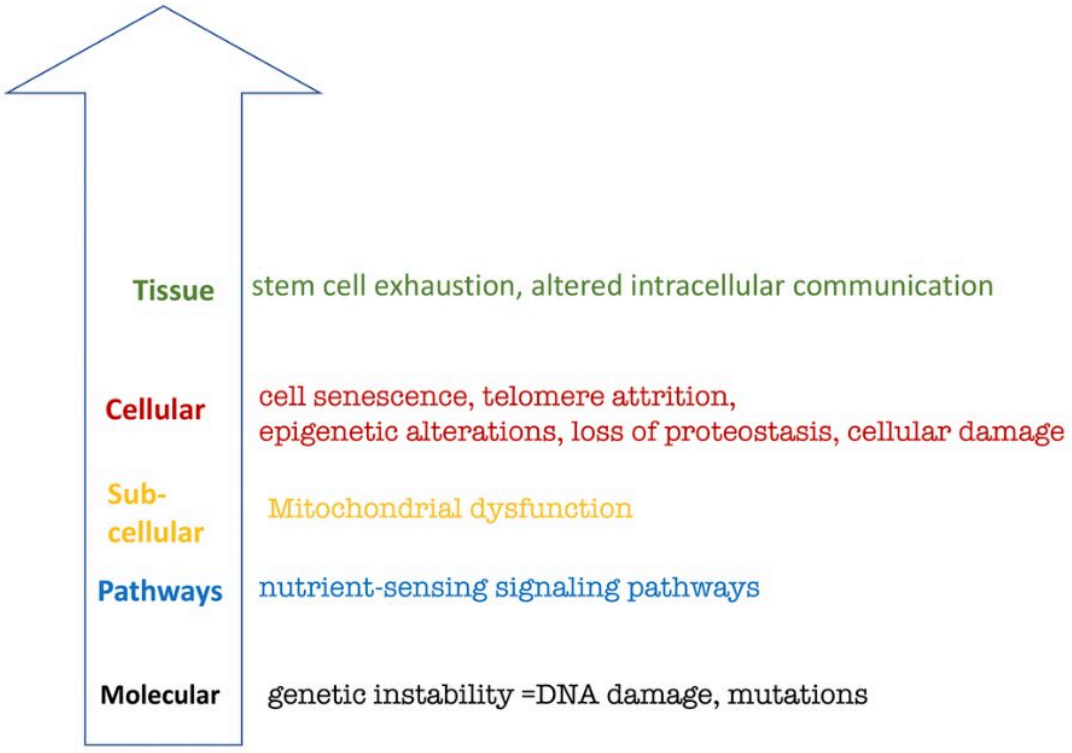

Figure 2. Hierarchical representation of the hallmarks of aging based on López-Otín et al. See text for explanation.

Hierarchical representation of the hallmarks of aging based on López-Otín et al. Credit: Aging-US.com

"This representation renders hallmarks tangible but reveals three shortcomings," he states.

The first shortcoming that Dr. Blagosklonny notes is the lack of hallmarks on the organismal level. The second is that the relationship between hallmarks on different levels is unclear. The third is that the

inclusion of genetic instability as a hallmark is based on the theory that aging is caused by the accumulation of molecular damage: "The molecular damage theory was refuted by key experiments, as discussed in detail."

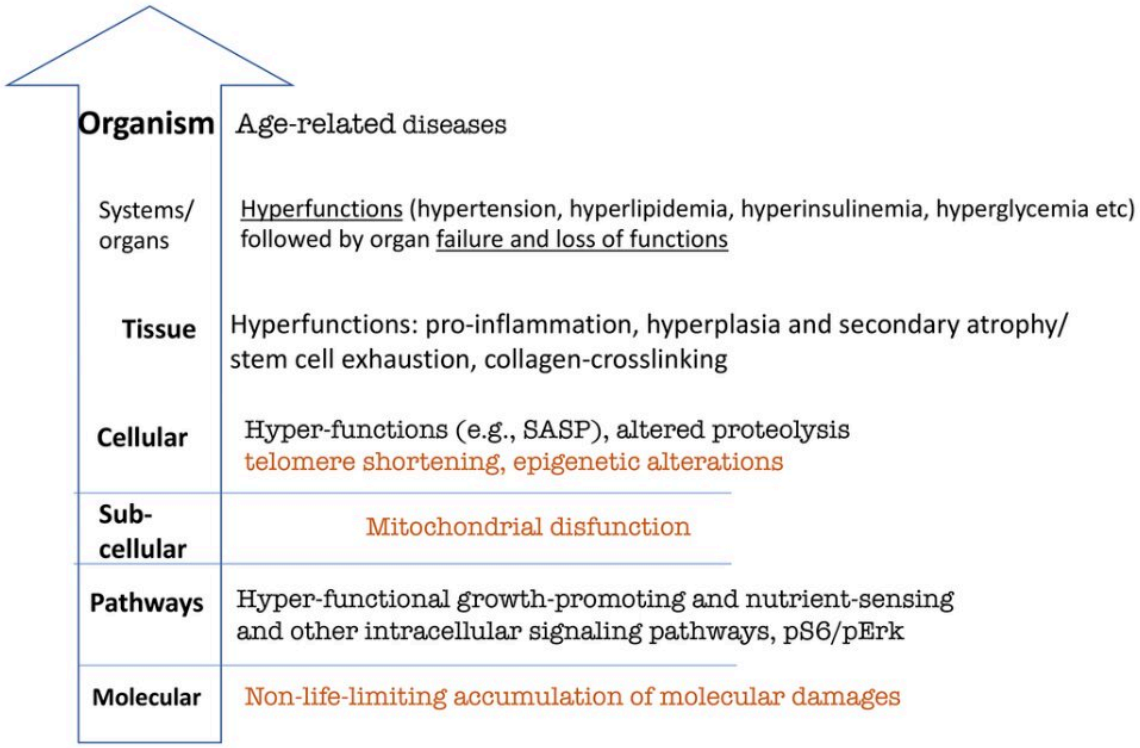

Figure 3. Hierarchical hallmarks of aging based on hyperfunction theory, applicable to humans. Non-life-limiting hallmarks are shown in brown color. See text for explanation.

Hierarchical hallmarks of aging based on hyperfunction theory, applicable to humans. Non-life-limiting hallmarks are shown in brown color. Credit: Aging-US.com

Dr. Blagosklonny then uses the hyperfunction theory to arrange the hierarchical hallmarks of aging: "Let us depict hallmarks of aging, according to the hyperfunction theory of aging."

Dr. Blagosklonny continues by discussing the key to understanding aging and aging as a selective force for cancer. He concludes this review by discussing the common hallmarks of cancer, aging and cell senescence, stating, "In organismal aging, cancer and cellular senescence, the same key signaling pathways, such as mTOR, are involved. This is why the same drugs, such as rapamycin, can suppress all of them."

More information: Mikhail V. Blagosklonny, Hallmarks of cancer and hallmarks of aging, *Aging* (2022). DOI: 10.18632/aging.204082

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