Knowledge Systematization of Cellular Senescence Process by Homeostasis Imbalance Process Ontology

○ Yuki Yamagata[1)2)], Shuichi Onami[1)2)], and Hiroshi Masuya[1)3)]

1) Laboratory for Developmental Dynamics, RIKEN Center for Biosystems Dynamics Research,
2) RIKEN Information R&D and Strategy Headquarters,
3) RIKEN BioResource Research Center

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Yuki Yamagata yuki.yamagata@riken.jp

BACKGROUND

- As explained in several textbooks, aging is not a disease, but a risk factor.
  - ➡ Can we regulate aging?
- Aging has already begun from birth, and senescence is repeated at the cell level throughout our life.
- Recent studies suggest cellular senescence plays both suppressor and inducer in cancer.
  - ➡ What mechanisms underlie aging?

APPROACH

- Develop an ontology: **Homeostasis Imbalance Process Ontology (HoIP)**

https://bioportal.bioontology.org/ontologies/HOIP
cellular senescence course:
http://purl.bioontology.org/ontology/HOIP/HOIP_0060024

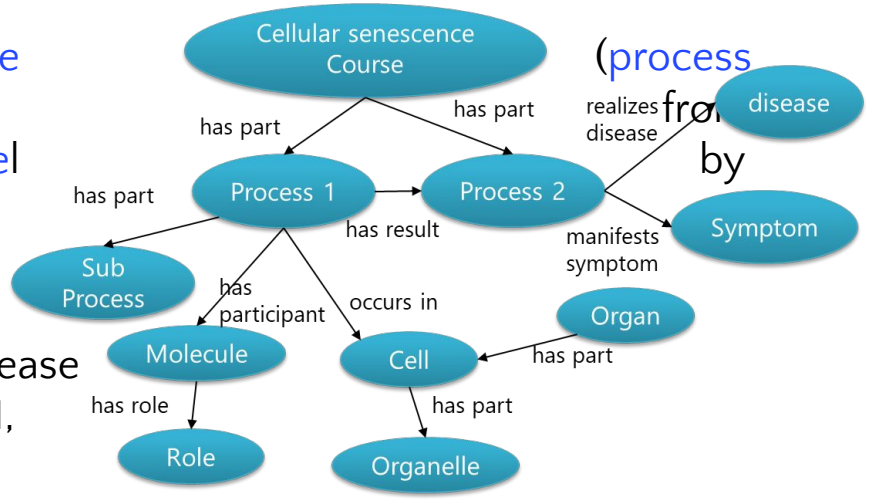
OBJECTIVES

- To systematize knowledge of the cellular senescence processes based on an ontological approach.
- To clarify how cellular senescence develops into pathological manifestations, symptoms, and age-related diseases.

Challenge: coping with the granularity from micro to macro levels

How do we represent the granularity of a wide variety of phenomena from molecule to cell levels?

- Describe a mechanism as a course series) for phenomena spanning cell to disease at an organism level manual annotation
- Unify the representation of functioning process, structure, molecule, role, symptom, and disease by referring to BFO, GO, UBERON, HP, SYMP, PRO, and ChEBI



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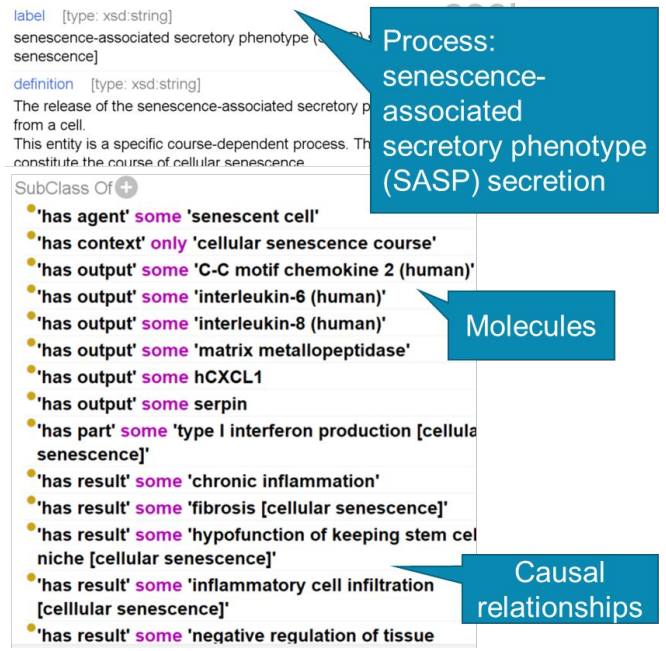

Manual annotation from textbooks and review articles

Ontology editor: Protégé 5.5.0

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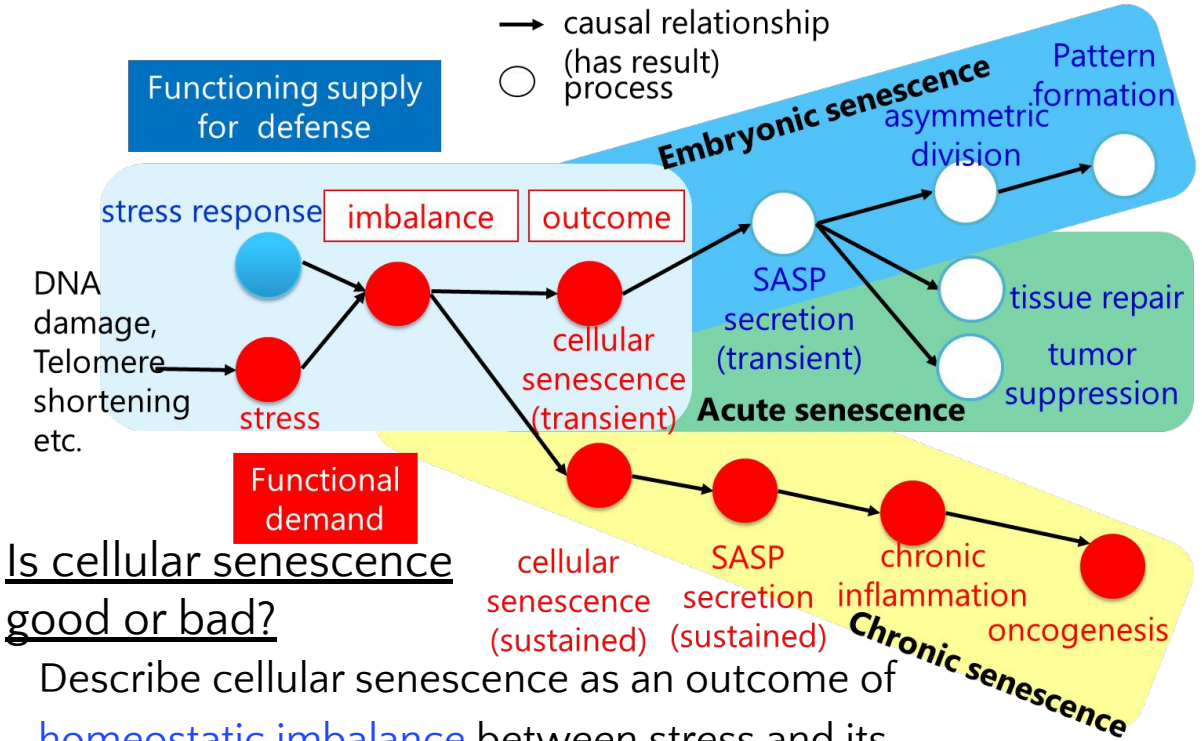
Challenge: explicating the commonalities and differences from mixed-up knowledge

Homeostasis imbalance model



Is cellular senescence good or bad?

- Describe cellular senescence as an outcome of homeostatic imbalance between stress and its response

Our imbalance model makes explicit the differences:
Cellular senescence:

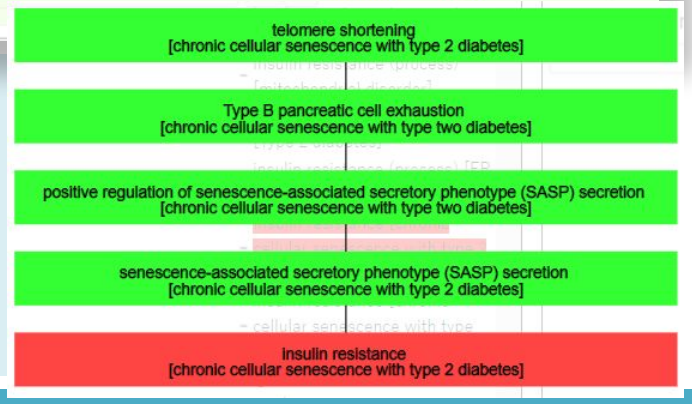
- Benefits: tissue remodeling in embryonic and tumor suppression in acute senescent cells
- Harmful effects: chronic inflammation, oncogenesis in chronic senescent cells

Challenge: Finding new mechanisms link to diseases

Why is cellular senescence a risk factor?

DL query:
possible causes of insulin resistance

Inference using HoIP revealed 32 potential causes and various pathways associated with type 2 diabetes and chronic cellular senescence course, providing clues to unknown mechanisms.



Contact Us Yuki Yamagata yuki.yamagata@riken.jp