

## Sample answer

1.

1)

Senescence is a programmed cellular response and state that is activated after stress such as irreparable damage, especially associated with during disease or chronic aging.

2)

DNA damage, reactive oxygen species (ROS), oncogenic signaling, disease, neurodegeneration, aging

のうち3つで正解

3)

iPSC-derived neurons in vitro from individuals with Parkinson's disease, spinal cord injury, and hyperinsulinemia, mouse neurons that contain DNA double-strand breaks (DSBs) in vivo, prolonged cultured rodent and human neurons in vitro

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4)

3. Autophagy

5)

4. Changes in nuclear size and structure, and epigenetic restructuring are prominent in neuronal senescence by the presence of DSB marker phosphorylated histone H2AX (γ-H2AX).

## 2.

1)

Dr. Yamanaka was surprised to find that both iPSCs and ESCs are nearly indistinguishable, by sharing overlapping features in gene expression, epigenetic status, and differentiation propensity regardless of their very different origins and derivation methods.

2)

Regenerative medicine, drug discovery, transplantation of iPSC-derived corneal sheath, elucidation of Neanderthal brains, preservation of endangered species, modeling of human embryos

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3)

Since there are significant heterogeneity among iPSC clones even from the same donor, technological advances to reduce such heterogeneity and decrease in the time and cost are needed.

4)

Dr. Yamanaka had encountered unexpected results in his early career, which took him to new fields that he had not imagined, eventually leading to iPSCs. For example, a reagent he expected to prevent hypotension in animals induced hypotensive shock. A transgene he expected to prevent atherosclerosis in mice caused massive hepatocellular carcinomas. Based on these experience, he advised young people to regard unexpected results as a big chance to start something new and unique studies.

## 3.

The purpose of the question is to assess whether you can logically organize and express your intended graduate research in English.