

※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

Yoshinori Ohsumi, Nobel Laureate in 2016 Physiology or Medicine, uncovered and determined molecular and cellular mechanisms underlying autophagy, an important process for degrading and recycling cellular components. He used electron microscopy to reveal autophagy as a means of delivering intracellular components to the lysosome. Dr. Ohsumi also identified 15 autophagy-related genes that are essential for autophagy in yeast, and many of these genes are conserved between mammals and yeast. Autophagy contributes to important physiological functions, such as embryo development and cell differentiation. Disturbances in autophagy have also been linked to diseases such as premature aging, cancer, and neurodegenerative disorders.

Please answer the following questions.

1. To the best of your knowledge, what is lysosome? (10%)
2. Design any experiments that may help identify autophagy-related genes in yeast. (30%)
3. After you have successfully identified the autophagy-related genes in yeast, what experiments can you do to study their functions in embryo development and cell differentiation? (20%)
4. Design any experiments that may determine the role of autophagy in premature aging, cancer, and neurodegenerative disorders. (20%)
5. In the future, what research directions can you take to help cure human diseases associated with defective autophagy? (20%)