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國立臺灣大學 108 學年度碩士班招生考試試題

科目： 全球生技與醫療策略

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In the nature, CRISPR evolved as a bacterial defense mechanism: during viral invasion, bacteria capture snippets of the invader's DNA and stick them into repeating segments. Upon new attack of the same virus, bacteria would then turn the segments into recognition RNA templates attached to enzyme scissors that can cut the complementing DNA, thereby inactivating the viral genome. Now, science has turned CRISPR into a revolutionary DNA-editing technology that opens up new paths from treating disease to improving crops.

1. Using simple sketch/diagrams, describe your conception of the CRISPR technology. Feel free to encompass any aspects of your interest, from history, mechanism of action, socio-economical impact, to ethical issues etc., all welcomed. (30pts.)

2. Looking for creating disease- or weather-resistant crops, CRISPR is particularly attractive to the agricultural industry. For instance, Taiwanese banana production has been suffering from a pathogenic fungus *Fusarium oxysporum cubense* TR4, that kills banana plants by choking them of water and nutrients. Place yourself as a responsible scientist devoted to solve this problem for Taiwan, and describe how you may contribute using (or not) the CRISPR technology. State the required know-how and team members that you may need, as well as the possible obstacles that you may encounter. (30 pts.)

3. Chinese researcher He announced in an interview last year his project on CRISPR edited human embryos to bear the CCR5delta32 mutation, that involves at least a pair of twins born by late 2018. CCR5 encodes for a protein that HIV uses to enter human cells, the mutation delta32 hampers viral entry and thus may possibly confer resistance to HIV infection. He said that despite the CRISPR editing, the twins still carried functional copies of CCR5 along with CCR5delta32. Based on your knowledge or logical inference, please comment on (a) the possible reasons that resulted into this mosaic pattern of CRISPR editing, and (b) would a single mutation be sufficient to confer HIV resistance. (30 pts.)

There was widespread criticism in the scientific community over the conduct of the project and concerns raised for the long term wellbeing of the twins. The project had not been peer reviewed or published in a scientific journal, and it was unclear whether the participants had given truly informed consent. Please relate your opinion on He's act, and comment on why it resulted in such a strong reaction. (10 pts.)

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