

受験番号	
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令和 9 年度 4 月入学、令和 8 年度 10 月入学

北海道大学大学院医理工学院 修士課程 課題論文（共通課題）

課題 1 及び課題 2 に答えよ。

課題 1

医療従事者や患者の放射線被ばく線量管理において ALARA (As Low As Reasonably Achievable)の原則が国際的に確立されてきた。近年、がん検診や心血管画像診断の需要増大に伴い、低線量化と画像品質の両立が焦点となっている。放射線画像診断技術の発展と普及に関して、さらなる低線量化・高品質化の実現可能性と、技術普及に伴うインフラ整備・コスト・被ばく管理の観点から生じる便益とリスクについて、自身の考えを 600 字以上 800 字以内で述べよ。

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Essay Examination (Common topic) for Master's Program
Graduate School of Biomedical Science and Engineering, Hokkaido University
(April 2027 enrollment, October 2026 enrollment)

Answer the following questions 1 - 2.

Question 1

The ALARA (As Low As Reasonably Achievable) principle has been internationally established for managing radiation exposure doses among healthcare workers and patients. Recently, the growing demand for cancer screening and cardiovascular diagnostic imaging has focused on balancing low radiation doses with high image quality.

Regarding the development and widespread adoption of radiological imaging technologies, discuss your perspective on the feasibility of achieving both lower-dose and higher-quality imaging, as well as the benefits and risks that arise from technological dissemination in terms of infrastructure development, costs, and radiation dose management. Please write your thoughts in 40–50 lines.

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課題 2

生命の最小単位である細胞を人工的に構築する「人工細胞」の研究が長年行われている。広義には iPS 細胞や*CAR-T 細胞などの人為的な性質改変、シミュレーションに基づく「バーチャル細胞」もこれに含まれる。このような「人工細胞」あるいは「人工生命」の研究は、医理工学ひいては人間社会に、何をもたらすだろうか。期待や懸念、利点や問題点、実現性など多角的な視点から、具体的に 600 字以上 800 字以内で論述せよ。

*CAR-T 細胞：がん患者から採取した免疫細胞（T 細胞）に遺伝子改変を行って、がん細胞に対する攻撃力を人工的に高めたもの。

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Question 2

Research on “artificial cells”—which involves the artificial construction of cells, the smallest units of life—has been ongoing for many years. In a broad sense, this also includes artificially modified cells such as iPS and *CAR-T cells, and “virtual cells” based on simulations. What will this kind of research on “artificial cells” or “artificial life” bring to the fields of Biomedical Science and Engineering, and ultimately to human society? Discuss from multiple perspectives, such as expectations and concerns, advantages and problems, and feasibility, in 40-50 lines.

*CAR-T cells: Immune cells (T cells) extracted from cancer patients that have been genetically modified to artificially enhance their ability to attack cancer cells.