日本大学大学院薬学研究科入学試験問題

受験番号		氏　　名	

英　語（基礎薬学分野）

以下の文章はヒトの微生物叢 (microbiota, microbiome) に関する総説の一部である。文章を読み、以下の問に答えなさい。

Microorganisms reside in their preferred environment depending on their optimal growth conditions. They can be found on the human body's external and internal parts as well as entrance sites. The external sites that house microorganisms include the skin, eyes, and even the exposed sites under the nails. The portals of entry for microorganisms are the respiratory tract (mouth and nose), gastrointestinal tract (oral cavity), urogenital tract, and breaks in the skin surface. Meanwhile, the internal parts of the body that are occupied by microbes include the lungs, gut, bladder, kidneys, and vagina.

Microbes tend to thrive in an environment that is suitable for them. Hence, these microorganisms are predicted to have mechanisms for adapting to conditions in the human microbiome that resemble their preferred natural environment. Environmental factors such as temperature, pH, oxygen concentration, pressure, osmolarity, and nutrient source contribute to the diversity and abundance of microorganisms at different sites of the body. For instance, our body temperature is optimal for housing many different types of microbes. Other factors, such as the presence of nutrient sources like sebum, change the skin's pH and also act as a carbon source, facilitating the growth of certain groups of microbes. Interestingly, the dense layer of mucus that covers the intestinal epithelium not only serves as a carbon source for microbes but also provides attachment sites for bacterial adhesion.

The abundance and diversity of the human microbiota is dependent on intrinsic and extrinsic factors. Intrinsic factors include the nature of body environments, as previously described, as the physiology of habitat sites facilitates the growth of some microbes. Other intrinsic factors that contribute to the microbiome's composition include genetics, ethnicity, gender, and age. The human microbiome is generally stable and resistant once the microorganism has adapted to the environment. On top of intrinsic factors that may cause a shift in the microbiome over time, extrinsic factors such as diet, lifestyle, medication, geographic location, climate, and seasonality may cause changes to the microbial community. Moreover, the mode of delivery during birth has been shown to influence the microbiome. For example, newborns delivered via the vaginal versus Caesarean delivery possess different groups of dominating gut microbiome. However, at the age of 3, the gut microbiome changes to resemble that of the adult's gut microbiome. As people reach beyond the age of 70, the ability to digest food and absorb nutrients in the gut changes, affecting the composition of the gut microbiome. With decreasing immune activity in older adults, this also contributes to changes in the overall microbiome as they are more susceptible to pathogens—thereby influencing the core microbiome. As *Bifidobacterium* spp. stimulates the immune system and metabolic processes, a decrease in Bifidobacteria may result in malnutrition and low systemic inflammatory status in older adults. Altogether, the human microbiome thrives in optimal growth conditions, depending on the natural environment of the body. When the natural environment of the body is altered, this results in microbial composition and diversity shifting to adapt to the changing environment, potentially resulting in disease.

（出典：*Chem. Rev.* 2023, 123, 31−72）

[注] portals of entry: 侵入門戸, osmolarity: 浸透圧, sebum: 皮脂, intestinal epithelium: 腸管上皮, mode of delivery: 分娩様式, core microbiome: コアマイクロバイオーム（個人の違いによらず、多くの人に共通して存在する中核的な微生物群）, systemic inflammatory status: 全身性炎症状態

問 1　下線部を和訳しなさい。

問 2　ヒトの微生物叢の変化と疾患との関連性について具体例を挙げて説明しなさい。

問 3　この文章全体に対する見出しを考えて日本語で記しなさい。

採　点	