Innovative infection models for cellular microbiology.

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Introduction

Infectious diseases remain a significant global public health concern, and cellular microbiology plays a crucial role in understanding the mechanisms underlying the pathogenesis of microbial infections [1]. As such, developing innovative infection models is vital for studying these diseases and improving our understanding of the host pathogen interactions. In this article, we will discuss some of the cutting edge infection models that are currently being used in cellular microbiology research [2].

Organ on a chip models

Organ on a chip models have emerged as a promising tool for studying infectious diseases. These models are essentially miniaturized versions of human organs that can be used to mimic the complex interactions between host cells and invading pathogens. Organ on a chip models are typically composed of microfluidic channels that are lined with human cells and mimic the physiological environment of the organ being studied. For example, researchers have developed lung-on-a-chip models that allow them to study the interactions between respiratory pathogens and human lung cells [3]. Similarly, gut on a chip models can be used to study the interactions between gut microbiota and the human gut lining. These models have the advantage of being more physiologically relevant than traditional cell culture models and can be used to identify novel targets for drug development.

Description

3D cell culture models

Three Dimensional (3D) cell culture models are another innovative approach to studying infectious diseases. In traditional 2D cell culture models, cells are grown on a flat surface, which does not fully capture the complexity of the cellular microenvironment. In contrast, 3D cell culture models allow cells to grow in a more natural, three dimensional structures, which more closely resemble the architecture of tissues *in vivo*. Researchers have used 3D cell culture models to study a range of infectious diseases, including tuberculosis, hepatitis B, and Human Papilloma Virus (HPV). These models have the advantage of providing a more realistic environment for studying the interactions between host cells and invading pathogens, which can lead to the identification of new therapeutic targets [4].

Humanized mouse models

Humanized mouse models are another innovative approach to studying infectious diseases. These models involve transplanting human cells or tissues into immune-deficient mice, allowing researchers to study the interactions between human cells and invading pathogens *in vivo*. Humanized mouse models have been used to study a range of infectious diseases, including HIV, malaria, and tuberculosis. These models have the advantage of providing a more realistic environment for studying infectious diseases than traditional cell culture models. Additionally, humanized mouse models can be used to test the efficacy of new therapeutics before they are tested in humans [5].

Microbial co-culture models

Microbial co-culture models involve growing multiple microbial species together, allowing researchers to study the interactions between the species. These models have the advantage of more closely resembling the microbial communities that exist in nature and can be used to study the effects of different microbial species on host cells. For example, researchers have used microbial co-culture models to study the interactions between gut microbiota and the human gut lining. By growing different species of gut bacteria together in a culture, researchers were able to identify which bacteria were beneficial and which were harmful to the host. This information can be used to develop new therapeutics that target harmful bacteria while preserving beneficial ones.

Microbial co-culture models can also be used to study the interactions between different pathogens. For example, researchers have used these models to study the interactions between *Staphylococcus aureus* and *Pseudomonas aeruginosa*, two bacterial species that frequently co-infect patients with cystic fibrosis. By studying the interactions between these two species, researchers were able to identify novel therapeutic targets for treating these infections.

Conclusion

Innovative infection models are essential for advancing our understanding of infectious diseases and improving our ability to develop new therapeutics. Organ on a chip models, 3D cell culture models, *CRISPR-Cas9* gene editing, humanized mouse models, and microbial co-culture models are all cutting edge approaches to studying infectious diseases. These models have the advantage of being more physiologically relevant than

traditional cell culture models and can lead to the identification of novel therapeutic targets. By continuing to develop and refine these models, we can improve our ability to prevent and treat infectious diseases and ultimately improve global public health.

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