



**Title of Project : Neo-virology: the raison d'etre of viruses**

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**【Purpose of the Research Project】**

An ecosystem is a complex network of interactions among living organisms and the nonliving components of their environment. Generally, a living organism is defined as belonging to one of the three domains of life, the archaea, bacteria, and eukaryote domains, and therefore viruses are not considered living components of the global ecosystem. Given that approximately  $10^{31}$  viruses exist on Earth and all of them are parasitic in living organisms, it is not hard to imagine how virus infection might affect the physiological functions of hosts and the ecosystem. However, since traditional virology tends to focus on viral pathogenicity research, the significance of viruses and viral-mediated processes in the global ecosystem are poorly understood. Therefore, to identify previously unrecognized roles of the virus per se in nature, here we propose to establish a new academic field designated as 'Neo-virology'. In this research field, we define a virus as a component of the global ecosystem and aim to elucidate its key roles in host organisms and the global ecosystem.

**【Content of the Research Project】**

Our project consists of three research units: A01 "Coevolution", A02 "Symbiosis", and A03 "Diversity". In the A01 "Coevolution" unit, we propose to conduct comprehensive screens to identify endogenous virus-like elements in various hosts by using a deep sequence approach. We will elucidate the effects of identified endogenous virus-like elements on the biological functions and/or evolution of the hosts. Further, the mechanisms of coevolution of the virus and host will be analyzed.

In the A02 "Symbiosis" unit, we propose to elucidate the effects of symbiosis with the virus on the physiological functions and immune responses of the hosts, as well as their functional mechanisms, which will lead to an understanding of the essential roles of the virus in the regulatory biological processes of the host organisms.

In the A03 "Diversity" unit, we propose to conduct comprehensive screens to identify viruses that are yet-to-be discovered, in particular, in protocista and prokaryotes. We will also identify the mechanisms of the life cycles of the newly identified viruses, which will lead to an

understanding of the novel roles of these viruses in the global ecosystem.

In this project, we will analyze data sets collected from various living organisms and environments by utilizing system-biology approaches to understand the mechanism of the virus-regulatory ecosystem.

**【Expected Research Achievements and Scientific Significance】**

This research project is expected to lead to the establishment of a new research field to understand the roles of viruses in host living organisms and in the global ecosystem. It has the potential to generate new uses for virus as tools to regulate ecosystems, and may lead to solutions for serious environmental problems, such as global warming, CO<sub>2</sub>-induced climate change, and desertification. This research project is expected to develop into an important scientific field that examines the interactions between the global ecosystem and viruses.

**【Key Words】**

Virus-regulatory ecosystem studies: Elucidation of the key roles of viruses in host organisms and the global ecosystem.

**【Term of Project】** FY2016-2020

**【Budget Allocation】** 1,061,100 Thousand Yen

**【Homepage Address and Other Contact Information】**

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