

**【Grant-in-Aid for Scientific Research on Innovative Areas (Research in a proposed research area)】**  
**Interdisciplinary Area**



**Title of Project : Preventive medicine through inflammation cellular sociology**

**Kouji Matsushima**  
(The University of Tokyo, Graduate School of Medicine, Professor)

Research Project Number : 17H06391      Researcher Number : 50222427

**【Purpose of the Research Project】**

Faced with an aging society, a paradigm shift from reactive to preventive health care is urgently required. In this project, by characterizing the non-hematopoietic tissue cells and infiltrating immune cells in inflamed tissues at a single-cell level—individual components that together make up a “cellular society of inflammation”—we will investigate the origin, pre-disease condition, progression and irreversible changes of inflammatory disease. Based on comprehensive single-cell transcriptome and informatics approaches, we will integrate research from the fields of inflammation, pathology and clinical science in order to model the course of disease—the transition of the cellular society of inflammation. We will also clarify the mechanisms underlying this transition, with focus on factors that regulate cell function such as metabolism, senescence, mutation and the microenvironment, as well as inflammatory mediators that make up inter-cellular networks. These studies will enable us to generate mechanistic models that simulate the development and progression of chronic inflammatory disease. By exploring the cellular society of inflammation, this novel approach to preventive medicine will establish the internal and external environmental factors that predict disease risk and identify early diagnostic markers and novel molecular targets.

**【Content of the Research Project】**

A01 Establishment of the cellular society of inflammation for chronic inflammatory disease: We will collect single-cell transcriptome data together with spatio-temporal information in a range of disease models with different pathogeneses and affecting different organs, thus defining the origin, pre-disease condition, progression and irreversible changes (e.g. fibrosis) of each disease.

A02 Regulation of the cellular society of inflammation by environmental factors and establishment of molecular targets for preventive therapies: We will investigate the links between physiological factors such as environmental stress, genetic factors, shear stress, hypoxic stress and

aging, chronic inflammation, and lifestyle-related diseases, thereby exposing novel molecular targets.

A03 Socio-cellular informatics: We will develop new methods for analyzing and integrating data from a range of sources including comprehensive single-cell transcriptome data, and construct models that simulate chronic inflammatory disease.

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

This project will establish a model of the cellular society of inflammation that reveals the mechanisms underlying disease transition. Using quantitative molecular and cellular information, this project will identify turning points in the progression of disease and support the development of innovative preventive medicines that are designed to precisely control those turning points. The simulation models of the cellular society of inflammation generated by this project for various chronic inflammatory diseases will provide numerical information regarding environmental risk factors and enable scientific risk management. By providing a bird’s-eye view of the process of disease progression and by providing a public platform for models of the cellular society of inflammation, we expect that this project will predict drug actions, thus promoting the repositioning of existing drugs and facilitating the discovery of drugs with completely new mechanisms of action.

**【Key Words】**

Cellular sociology of inflammation: A novel approach to life science and preventive medicine that interprets inflamed tissues (cellular societies) at the single-cell level.

**【Term of Project】**      FY2017–2021

**【Budget Allocation】** 1,195,200 Thousand Yen

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

<http://inflammationcellularsociology.org>  
[koujim@m.u-tokyo.ac.jp](mailto:koujim@m.u-tokyo.ac.jp)