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Immunology and Its Future in the Research

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Abstract

The aim of systems biology is to provide a system or multilevel understanding of biological processes through the integration and modeling of different data sources. The complexity of immunology and infection of microorganism cannot be untangled by investigating it from a reductionist point of view. Therefore immunology and infection microbiology, with all its complex interactions between different species, different cell types, different regulatory and signaling pathways, and different molecules and genes, which always could not be measured directly by experiments in wet lab, provides a perfect environment for the development and use of approaches based on systems biology.

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Introduction

Due to the advanced "-omics" methods, big data mining and systems biology technologies, systems immunology and infection microbiology will play a central role in the new era of big data–driven and system-driven medicine research. Based on big database mining, network modeling, and two-sided genome-wide high-throughput data, we could construct host–pathogen interaction networks at different infection stages. Through principal network projection and comparison between interaction networks at different infection stages, we could obtain core network biomarkers to research the many offensive and defensive mechanisms between host and pathogen. Accordingly, we could also design therapeutic drug by drug data mining based on these core network biomarkers from systems medicine.

Immunology began as a subdiscipline of microbiology, and lots of of the first investigators within the field focused on developing methods to stop or cure infectious diseases. This focus led to the development of vaccines against potential pathogens as well as formulation of drugs to eliminate infectious microorganisms once they had invaded the host. This specialise in addressing practical, clinically related questions provides a solid foundation for the longer term of the discipline.

During these early studies, immunologists unraveled many of the mechanisms responsible for the success of the innate host defenses and the adaptive immune responses as well as providing an insight into a variety of pathologies, including immunodeficiency disorders, autoimmune diseases, and hypersensitivities resulting from abnormal or aberrant reactions. Today's immunology student is faced with the daunting task of assimilating the knowledge domain accumulated over the past 200 years also as applying this information to the longer term. To envision the longer term, immunology students got to realize the following: (1). Technology drives science, and the development of new technology will determine the course of the discipline. (2). New diseases are continually emerging—many of those are infectious, and most are going to be amenable to review by immunologists. (3). New therapies, some supported immunologic principles, will appear, and their effect on host defense mechanisms will got to be determined. (4). Immunologic mechanisms liable for some well-known diseases like atherosclerosis are going to be discovered and challenge immunologists to plan new drugs and therapies.